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BULLETIN

DE LA

SOCIÉTÉ ENTOMOLOGIQUE D'EGYPTE

(Société Royale Entomologique d'Egypte (1922 - 1937)
et Société Fouad Ier d'Entomologie (1938 - 1954))

FONDÉE LE 1er AOUT 1907

PLACÉE SOUS LE HAUT PATRONAGE DU GOUVERNEMENT EGYPTIEN
PAR DÉCRET EN DATE DU 15 MAI 1923

LE CAIRE

IMPRIMERIE FRANÇAISE

1955

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A Review of the Pompilidae of Egypt

[Hymenoptera]

(with 32 Illustrations)

by Prof. Dr. H. Priesner

PREFACE

The present Review is based upon the study of various collections, especially that of the Ministry of Agriculture in Cairo, that of the Egyptian Entomological Society, the collections of A. Alfieri and the late Dr. A. Mochi, the small collections of both the Cairo and Heliopolis Universities, and my own material. Some interesting Egyptian Pompilidae I also found in the collection of the Natural History Museum in Vienna.

Thus I could not have accomplished this paper without the help of my colleagues : Mr. A. Alfieri of the Egyptian Entomogical Society, M. Hosny Eff. and M. Abdel Hamid Eff. of the Ministry of Agriculture, the Professors H. C. Efflatoun and Dr. M. Hafez of the Cairo University, and Prof. Dr. Taher Sayed of the Ein Shams University who put the collections in their charge at my disposal. Dr. A. Mochi junior (Damascus) allowed me to study the material of his father. Dr. G. Arnold (Bulawayo) very kindly presented to me the last spare copy of his invaluable work on the Ethiopian Pompilidae, and Mrs. D. Guiglia (Genova) supplied me with her interesting papers on this group. Dr. H. Haupt (Halle) with whom I had been in correspondence for years, gave me, besides all other publications of his, a copy of his manuscript on the Palestinian Pompilidae. To Dr. M. Beier I owe the permission to examine Kohl's types in the Vienna Museum.

INTRODUCTION

The student of this family finds a general characterisation of it either in Schmiedeknecht's « Hymenopteren Mitteleuropas » or in Berland's « Faune de France ». However, for a thorough study the following works have to be recommended : H. Haupt, Monographie der Psammocharidae (Pompilidae) Mittel- Nord- und Ost-Europas (*Deutsche Ento. Zeitschrift,* 1926-1927), and G. Arnold, Psammocharidae (Pompilidae) of the Ethiopian Region (*Ann. Transvaal Museum,* 1932-1937). These works contain detailed descriptions of the subfamilies and genera, which are purposely not repeated in this paper.

With regard to the system of the higher groups, genera and species, I have in general adopted the classification of Haupt and Arnold, but owing to my view of the importance of the wing venation I ventured to suggest some minor changes in the system, particularly as to subfamilies, tribes and genera.

The nomenclature of the wing venation I adopted in this paper is exactly that of Haupt which names the cells after the veins behind which they are situated. It may seem revolutionary to the Hymenopterologist but it is the most reasonable one, and should be adopted generally.

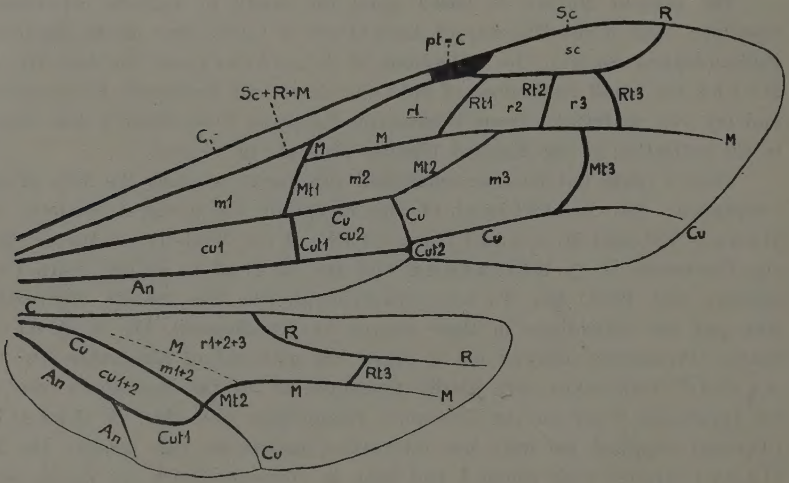

Fig. 1: Wings of a Pompilid (*Ctenagenia*) to show terminology of venation: An = analis; C = costa; c = costal cell; Cu = cubitalis; cu 1, 2 = cubital cells; Cut 1, 2 = cubital transverse veins; M = medialis (media); m 1, 2, 3 = medial cells; Mt 1, 2, 3 = medial transverse veins; M+Mt = basalis (basal vein); pt = pterostigma; R = radius; Rt 1, 2, 3 = radial transverse veins (formerly cubital transverse veins); r 1, 2, 3 = radial cells (formerly cubital cells); Sc = subcosta; sc = subcostal cell; Sc+R+M = subcosta+radius+media.

The antennal joints I have numbered from 1-12 (13), and have avoided to name the first joint « scape », the second « pedicel » and the following joints « flagellum », because it is simpler and does not lead to confusions.

In the descriptions I have utilized the characters as they are given in the fuller descriptions of previous authors, especially Haupt's and Arnold's. Besides these, I have found and included some additional characters.

There is the well known row of spines at the exterior edge of the fore tarsal segments of the females (that are seldom well developed in the males), especially of the *Pompilinae* and *Epipompilinae*. The colour, length, number and shape of these often long spines, representing the so-called *tarsal comb* has been a very useful means for distinguishing species. However, besides these lateral spines, there are in addition on the fore tarsi, chiefly on joint 1, some spines on the *under side* of the tarsal joints (cf. fig. 23). Best developed are these lower spines in *Dicyrtomellus, Telostegus* and *Leuchimon,* though they occur in some *Pompilus, Evagetes* (sens. lat.), *Schistonyx* and *Episyron,* too, and they are most useful as a specific character in combination with the other known characters. These inferior spines of the fore tarsus were, though well known (¹), hitherto not mentioned in the descriptions, or were sometimes confused with the lateral spines.

The single or double row of spines on the under side of the last tarsal joint, best seen on the hind tarsi, is not always developed. This character, used in the descriptions given by Arnold, is certainly only of specific or at most subgeneric value, but is important in this respect, and should be mentioned in the description of every species. In the subgenus *Arachnospila* (of *Pompilus*) e. g. all species are, as far as I was able to ascertain, devoid of these small spines on the under side of the tarsal joints. In the males the under side spines of the last tarsal joint are weak or, in most cases, entirely wanting.

Another interesting character consists in the symmetry or asymmetry of the claws of the fore tarsi of the males.

The males of the bulk of the genus *Pompilus* (sens. lat.) have the exterior claw of the fore tarsus normal while the interior one is stouter, more strongly curved ; in some large species it is even slightly bent outward again at the apex so that it is somewhat concave at the tip, exteriorly (fig. 2). The tooth of the interior claw is situated at the base, is large and directed forward so that the interior claw appears to be bifid also in species where all other claws are dentate (fig. 5). This tooth of the interior claw is sometimes pointed (e. g. *P. arenicola*), but mostly rounded or blunt or obliquely truncate. In *Pompilus* (sens. lat.) only a few species have normal, i. e. symmetrical, claws, as e. g. *P. pulcher* F., *P. aegyptorum* n. sp. and *P. signatipennis* Klug. *Pompilus pulcher* comes, not only by this character

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(¹) cf. Haupt, *Mitt. Zool. Mus. Berlin,* XV, 1929, p. 149 (*Dicyrtomellus claviger* Tsch.).

very close to *Dicyrtomellus,* but also by the possession of under side spines of the first metatarsus, and by the slightly enlarged (lanceolate) lateral spines of the same metatarsus. Not only the males of *Pompilus* (s.l.) have asymmetrical fore claws, but such are also present in *Ctenagenia, Evagetes* (s.l.) and *Xenaporus.* In the genera having bifid male claws there is also a difference between the interior and exterior claw, as e. g. in *Anoplius, Platydcres, Schistonyx* and *Pompiloides,* where the inner claw is shorter and more strongly curved, the tooth being stouter and blunter and more basad than that of the exterior claw. In *Episyron, Paracyphononyx* and *Telostegus* there is no noticeable difference in the bifid claws of the fore tarsus. Besides, all *Dicyrtomellus,* all *Pepsinae* and *Macromerinae* examined by me have symmetrically dentate claws of the males.

Another apparently hitherto overlooked character we find in the males of *Ceropales.* The ultimate joint of the fore tarsi shows an excavation before the apex interiorly that is, according to the species, more or less distinctly developed as a notch or an incision.

In judging the distances (pol) and (ool), i. e. in comparing the distance between the hind ocelli with that between the hind ocellus and the margin of the eye. I found in some cases that a certain asymmetry exists, namely (ool) of the left side not being quite equal to the same distance of the right side of the head. This deviation is, however, not very common so that this character, first introduced, I belieeve, by Haupt, does not lose its value.

The body measurements I gave are taken from specimens in which the head is not streched out horizontally, thus the body length is measured with the head in a vertical or slightly declivous position, as it is natural. In any case, the length of the body is a specific character of minor importance owing to the well known variability in size, of every species.

As indicated above, I kept the descriptions of the genera purposely very brief, confining myself to the most important distinguishing characters within the subfamily concerned. Long generic descriptions are of little value, particularly in a family where we have so many « weak » genera.

The Pompilid fauna of Egypt has certainly Palaearctic character, though with Ethiopic intrusions. Since the Egyptian fauna is predominantly Saharian we find that the number of species we have in common with Palestine on the one side, and the Ethiopian Region on the other is not very great. The genera richest in species are *Pompilus* (s. l.), *Evagetes* (s. l.) and *Telostegus.*

It is not surprising that the desert produced a good number of species having paler colours than in other biotopes, and such that are clothed with a more or less dense tomentum of silvery hairs, as this is the case with other Hymenoptera (cf. *Specidae*). Milky white opacity of wings also seems to be connected with life in the desert, and I wish to point out that this, as well as the just mentioned dense pile of some species, is a character of only specific value, as we find it in the *Epipompilinae* as well as in the *Pompilinae,* in the latter in the genera *Telostegus, Pompilus* (s. l.) and *Evagetes* (s. l.).

Fairly well known is only the fauna of Middle Egypt. Least known that of the Sinai peninsula. Many new species are still expected to be found in Egypt.

NOTES ON THE OLD LITERATURE

The most important references to Egyptian *Pompilidae* of the older literature are the following :

1. — Guérin deals with some of Savigny's (Descr. d'Egypte, 1812, pls. 17 and 18) species which were illustrated by the latter but not described. In *Magazin de Zoologie,* XIII, 1843, Guérin mentions two species, namely *Pompilus calidus* (pl. 17, fig. 18 of Savigny, l. c.) and *P. sabulosus* (l. c., pl. 17, fig. 19). *P. calidus* Guérin is no doubt identical with *P. teterrimus* Grib., while *P. sabulosus* Guérin is the same as *Cyphononyx flavicornis* (F.). *P. bretonii* Guérin (*Mag. Zool.,* XIII, p. 4, 1843) is a synonym of Klug's *P. fuliginosus* = *Batozonellus fuliginosus* (Kl.) Arnold. The other species illustrated by Savigny (l. c.) were not named by anybody; they are, moreover, certainly not all Egyptian. Some of them, though, can be recognized to a certain extent, namely :

Pl. 17, fig. 1 : *Platyderes* spec.; figs. 2 and 3 : *Cryptochilus* spp., males ; figs. 5-9 : *Cryptochilus* spp., females; fig. 16: *Ctenagenia vespiformis* (Kl.) ; fig. 22: *Paracyphononyx ruficrus* (Kl.). — Pl. 18, fig. 4 : *Dicyrtomellus, claviger* (Taschb.), female ; fig. 6 : *Pompiloides simulans* sp. n., female ; fig. 7 : *Anoplius fuscus* (L.), female ; fig. 8 : *Anoplius fuscus* (L.), male ; fig. 9 : *Anoplius infuscatus* (Lind.), female ; fig. 13 : *Pompilus arcanus* sp. n., female ; fig. 17 : *Evagetes* (*Tachyagetes*) *pharaonum* (Kohl), female ; fig. 14 : *Leuchimon* spec. ; fig. 19: *Xenaporus amoenus* (Kl.) ; fig. 18 : *Telostegus* spec. ; fig. 20 : *Ceropales opacior* spec. n. ; figs. 21 and 22 : *Pseudopompilus humboldti* (Dahlb.) ; figs. 23 and 24 : *Ceropales* spp.

2. — Klug's species (Symb. phys., 1834, pls. 38 and 39). The following of Klug's species, some of them being records new to Egypt, are Egyptian:

Pompilus vespiformis (from Syria) = *Ctenagenia vespiformis* (Kl.) ; *P. rutilus* (from Ambukohl, Sudan) ; *P. fuliginosus* (from Dongola) = *Batozonellus fuliginosus* (Kl.) ; *P. ornatus* (from Fayoum) = *Episyron ornatus* (Kl.) ; *P. festivus* (from Arabia) = *Episyron festivus* (Kl.) ; *P. castaneus* (from Ambukohl, Sudan) = *Cyphononyx castaneus* (Kl.) ; *P. anticus* (from Arabia) = *Episyron anticus* (Kl.) ; *P. signatipennis* (from Fayoum) ; *P.*

sugillatus (from Fayoum) = *Anoplius fuscus* (L.), male ; *P. gentilis* (from Arabia) ; *P. melas* (from Arabia) ; *P. umbrosus* (from Syria) = *Schistonyx umbrosus* (Kl.) ; *P. ruficrus* (from Fayoum) = *Paracyphonyx ruficrus* (Kl.) ; *P. tibialis* (from Fayoum) = *Paracyphononyx ruficrus* (Kl.) male ; *P. fumigatus* (from Sakkara) = *Telostegus fumigatus* (Kl.) ; *P. nigritulus* (from Sakkara) = *Telostegus nigritulus* (Kl.) ; *P. argyrellus* (from Fayoum) = *Telostegus argyrellus* (Kl.) ; *P. melanurus* (from Arabia) = *Telostegus melanurus* (Kl.) ; *P. sericans* (from Kasr Eshdabieh) = *Evagetes* (*Tachyagetes*) *sericans* (Kl.) ; *P. gracilis* (from Ambukohl, Sudan) = *Gonaporus gracilis* (Kl.) ; *P. amoenus* (from Abusir) = *Xenaporus amoenus* (Kl.).

The few remaining species of Klug have so far not been found in Egypt ; they are as follows : *P. glabratus* (from Ambukohl, Sudan) = *Hemipepsis glabrata* (Kl.) ; *P. brunneus* (Syria) = *Cryptochilus brunneus* (Kl.) ; *P. modestus* (from Ambukohl, Sudan) ; *Pompilus moestus* (from Syria) = *Pompiloides moestus* (Kl.) ; *P. clypeatus* (from Ambukohl, Sudan) = *Platyderes clypeatus* (Kl.).

3. — The species described by Spinola (*Ann. Soc. Ent. France,* 1838) : *Pompilus femoralis* (p. 458, l.c.) is a *Cryptochilus.* The description of the female does not agree with any of the Egyptian species known to me, that of the male is not exact enough for referring it to one of the latter. *P. fischeri* Spin. (l.c., p. 460) agrees very well with a unique specimen in Alfieri's collection. *P. enigma* Spin. (p. 461) is poorly described ; it is, moreover, not Egyptian, but just by Dalla Torre erroneously recorded as Egyptian. Spinola clearly states that its Patria is Turkey (« rives du Bosphore »). *P. waltli* (p. 462, *waltlii* Spin.) is a true *Pompilus,* and has been found by me again. *P. sericeus* Spin. (l.c., p. 462): this species was referred by Haupt (*Mitt. Zool. Mus. Berlin,* XVI, 1930, p. 698) to *Tachyagetes,* but Haupt does not state in the description that it is based upon Spinola's type. A species fully agreeing with that described by Haupt is not known to me from Egypt, but *sericeus* Spin. is said to be Egyptian. Haupt's *T. sericeus* is a form with broadly yellow margined pronotum, while Spinola states : « Tête, corselet et hanches noirs ». It is possible that Haupt's *sericeus* can be identified with *P. fricsei* Saunders, a species that Haupt puts as synonym to his *sericeus.* Of Egyptian forms with two radial cells only *T. communis* m. (in sched.) and *T. indutus* (Kohl) would agree with Spinola's description ; his remark « nervures obscures » excludes *indutus,* and we can thus assume that the actually very common species *communis* m. which is not identical with Haupt's *sericeus* = ? *friesei* Saund., is most likely identical with Spinola's *sericeus.* I prefer, therefore, to use the name *sericeus* Spin. for the in Egypt common species which I had preliminarily called *communis.*

4. — Dahlbom's species (Hym. Eur., I, 1843-1845). — Besides *Pseudopompilus humboldti* (= *Salius humboldti* Dahlb., l.c., p. 441) which was already put into the right genus by Haupt, the following species of Dahlbom are recorded as Egyptian by Dalla Torre (1897) :

Pompilus nigritus (l.c., p. 47, male). This species is not Egyptian, Dahlbom giving as habitat : « Patria ignota, forse Africa ad Promont. B. Sp. » (= Cape of Good Hope) ; the species is too poorly described anyway.

Salius schiôdtei (l.c., p. 441) originating from Rhodes (not Egypt), while Dalla Torre again quotes Egypt.

Homonotus fusciventris (l.c., p. 442) is Egyptian but, as to my knowledge only named, not described, and therefore a nomen nudum.

5. — Lepeletier described (Hist. Nat. Ins. Hym., III, 1845, p. 460) from Egypt *Anoplius fallax,* as follows :

« Ater, subpubescens. Abdominis segmento primum secundamque tertiique ferruginea. Alae fuscae, nervuris transversis, parte caracteristica ab apice praecipue infuscatis. Prothorax sat longus, postice rotundato emarginatus. Metathorax brevis, convexus, sulco dorsali longitudinali subimpressus, postice recte sectus. Cubitalis tertia dimidio a radialem angustata, secundae aequalis. Femina ».

« D'un noir foncé, un peu pubescent. Premier et deuxième segment de l'abdomen rougeâtres, ainsi que la base du troisième. Ailes enfumées principalement le long des nervures transversales, sur la partie charactéristique et au bout. Prothorax assez long, échancré postérieurement ; cette échancrure arrondie. Metathorax court, convexe, avec un léger sillon dorsal ; coupé droit postérieurement. Troisième cubitale rétrécie de moitié vers la radiale, aussi grande que la deuxième. Femelle ».

« Nota : Les pattes antérieures manquent à l'individu. Si cette espèce a les tarses de ces pattes ciliés, il faudra la rapporter au genre *Pompilus* ».

« Egypte. Musée de M. Serville ».

This description agrees with several Pompilid species. It must remain doubtful the more so as Lepeletier states that in the unique specimen the fore legs are missing. It can very well be *A. infuscatus,* though there are also several *Pompilus* species that would well agree with the above poor description.

6. — Taschenberg's *Aporus semirufus* (*Zeit. ges. Naturw.,* XXXIV, 1869, p. 69) can only be a *Telostegus.* The description runs as follows :

« Niger, argenteo micans, abdomine rufo, pygidio nigro ; alis sordide hyalinis, apice fumatis, tibiis tarsisque fortiter spinosis, horum anticis spatulatopectinatis, unguiculis furcatis. Long. 12 mm. Fem. — Chartum ».

« Auf die Gefahr hin, dass hier eine der beiden mir unbekannten und auch in ihren Beschreibungen nicht vergleichbaren Arten aus Afrika vorliegt, welche Spinola bereits benannt hat (sericeus, waltli), gab ich der vorliegenden einen selbständigen Namen ».

« Das Kopfschild ist vorn gerade abgestutzt und geht in gleichmässigem Bogen in die Seitenlinien über. Der am Hinterrand flachwinkelig ausgeschnittene Vorderrücken fällt von hier allmählich nach vorn ab, ohne sich merklich zu verschmälern und ebenso gleichmässig fällt der Hinterrücken nach hinten ab, sodass der ganze Thoraxrücken einen sehr gleichmässigen Bogen in der Seitenansicht darstellt. Seine ganze Oberfläche samt Hüften und Schenkeln der Beine sowie der Kopf erscheinen wie eine lackierte Fläche, die einmal schwarz, bei anderem Lichtreflexe silberweiss, bei einem anderen mehr grauweiss erscheint ; an den Backen stehen ausserdem noch einige weisse Haare. Der an der Wurzel etwas deprimierte, gegen die Spitze hin am Bauche komprimierte Hinterleib ist rot, mit grauem Dufte überzogen. Nur das letzte von oben plattgedrückte Glied ist mattschwarz, das vorletzte dunkelbraun, die Schienen und Tarsen sind sehr stachelig, die vordersten auffällig gekämmt, indem sich die Borsten nach vorn verdicken, am äussersten Ende aber wieder ein dünnes Aufsätzchen haben. Die Flügel sind schwach getrübt, am Hinterrand merklicher, und im Hinterflügel endet die Analzelle nahe vor dem Anfange des hier gleich sehr steil aufsteigenden Cubitalnerven ».

As Taschenberg puts this species to *Aporus* (s. lat.) it must have only two cubital cells. From the description I am quoting : « ... the last dorsally flattened abdominal segment is dull black, tibiae and tarsi very spinose, the anterior tarsi conspicuously combed, comb-spines thickened towards tips, but having a fine apical point. Anal vein of hind wing terminating near the beginning of the cubitus (Haupt's medialis) which just arises very steeply ».

The vertical medial vein is a good character of *Telostegus,* and also the spinose tibiae and the dull black flattened last tergite. The species is probably identical with *Telostegus melanurus* (Klug).

7. — Kohl's species, described from Egypt :

Pompilus platyacanthus (*Verh. zool. bot. Ges. Wien,* XXXVI, 1886, p. 322) is, according to Haupt and my own comparison with specimens in the Vienna Museum, identical with *Dicyrtomellus claviger* (Taschb.). However, I have to add that within the series of specimens of this species in the collection of the Vienna Museum there are two specimens of another species, named and described by me as *D. dentiprivus* sp. n., one of which also bearing the label « platyacanthus type ». See my remarks sub *D. dentiprivus,* below.

Pompilus atrohirtus (l.c., p. 322), identical with *P. teterrimus* Gribodo and *P. calidus* Guérin, the latter being the valid name.

Pompilus rhodosoma (l.c., p. 321), redescribed in this paper, below.

Pompilus pharaonum, type in coll. Mus. Vienna under this name, but, as to my knowledge, not described by Kohl. This species is common in Egypt, belonging to *Evagetes* (*Tachyagetes*).

Pompilus indutus, type also in the Vienna collection, but description also unknown to me. The species is described in this paper, it belongs to *Tachyagetes* (*Dasyagetes*).

8. — Walker's Egyptian Pompilidae. — *Pompilis innitens* Walker (List of Hym. collected by Lord in Egypt, etc., London 1871 (p. 15)) and *Pompilus melanophilus* (l.c.). The former is a large black species (9 lines) with blackish wings and is said to have a distinct keel on the propodeum. *P. melanophilus* is smaller (7.5 lines), has black wings and a scrabrous, not keeled propodeum. No other characters could be used from the very brief descriptions. Both species come from the Sinai.

Priocnemis brunneus (l.c., p. 15) according to Walker identical with *Pompilus brunneus* Klug (Symb. phys., pl. 38, fig. 2) = *Hemipepsis brunnea* (Klug). Walker's specimen was caught in Cairo, but the insect has never been found again here.

Agenia bizonata (l.c., p. 16), redescribed below under the name *Pseudagenia bizonata* (Walk.). From Cairo. — *Agenia terminalis* (l.c.) : « Male. — Black, dull, with cinereous tomentum. Mandibles red towards the tips. Metathorax with silvery pile, extremely finely punctured, not keeled. Abdomen with a white apical spot above. Legs red ; fore femora blackish above ; tarsi blackish. Wings cinereous, blackish at the tips; veins and stigma black. Length of the body 3 1/2 lines ». Wady Ferrân (Sinai). May be a *Pompilus.* — *Agenia tristis* (p. 16) : « Male. — Black, dull. Petiole very short. Wings cinereous, blackish towards the tips; veins and stigma black. Length of the body 3-3 1/2 lines ». Mount Sinai. This species cannot be recognized from the description.

Ferreola divisa (l.c., p. 17) and *Ferreola carbonaria,* redescribed below under *Platyderes.*

KEY TO THE SUBFAMILIES

1 (2) Medialis and Cubitus of fore wing attaining margin ; apical part of Cu subequal in length with base of cell r3 ; Mt3 straight, more or less vertical. Antennae stout, never convolute after death. Labrum large. Fore tarsi of female without comb spines, last fore tarsal joint of male with preapical notch within. Apex of hind femora in both sexes with irregularly placed small spines. Claws of posterior tarsi subrectangularly bent at apex. Apex of propodeum without distinctly raised margin. Second abdominal sternite without transverse furrow. Sixth

sternite of female folded, imitating an ovipositor. Body black or red, with yellow markings. .... **Ceropalinae Ashmead**

2 (1) Medialis of fore wing seldom reaching margin; Mt3 either not vertical upon M or not straight. Antennae of female convolute after death. Eyes not or less distinctly reniform. Claws of posterior tarsi never subrectangularly bent; fore tarsi of male without a notch within. Apex of propodeum with raised margin.

3 (8) Apex of hind tibiae with weak and short, straight, parallel spines of about equal length on part of upper and under side, or without spines. Second abdominal sternite of female usually with a sharp transverse furrow often directed backward at the sides. Hind tibiae at exterior margin either serrate or very closely set with rows of spines, or nearly bare. Cell m3 of fore wing rarely extended downward at the proximal lower angle, i.e. vein Cu straight on the spot where it meets Cut2.

4 (5) Hind tibiae of female with a serrate carina or a row of scales flanked by one or two rows of closely set spines. Nervulus (except in *Calicurgus*) distinctly postfurcal. Terminal part of Cu of hind wing more or less evenly curved (not broken in apical third) .... **Pepsinae Ashmead**

5 (4) Hind tibiae of both sexes more or less *sparingly* spinose.

6 (7) Terminal part of Cu of hind wing strongly curved. 1st abdominal segment more or less distinctly petiolate. Last three joints of maxillary palpi very long. Antennae long and slender, of male never pectinate or serrate. Tibiae very sparingly spinose. Claws not bifid. Head of male never densely pilose .... **Macromerinae Haupt**

7 (6) Terminal part of Cu of hind wing straight or very slightly and evenly curved. 1st abdominal segment usually sessile. Tibiae distinctly spinose. Last three joints of maxillarly palpi rather short. Antennae usually fairly short, of male pectinate or serrate. Head of male densely pilose .... **Ctenocerinae Arnold**
(*Claveliinae* Haupt)

8 (3) Apex of hind tibiae, besides the calcaria, with a few splayed out spines of unequal length that are not regularly spaced. No scales or serrate carina on exterior margin of hind tibiae. Second sternite of female never with a *sharply* impressed transverse furrow, only sometimes with a shallow transverse impression. Second discoidal cell of fore wing (m3) in most cases angularly extended downward at the lower basal angle (i.e. the terminal part of the Cu bent at the spot where it meets vein Cut2); terminal part of vein Cu of hind wing fairly straight or only slightly curved, but more abruptly bent (or broken) in apical third (except in the *Homonotinae*).

9 (10) Vein R of hind wing angularly curved (broken) near base, and the vein Rt3 joins it at the bend (Fig. 30). **Epipompilinae Haupt**

10 (9) Vein R of hind wing only curved, not angularly broken, vein Rt3 remote from base of R (Figs. 1, 3 and 4).

11 (12) Vein Cut of hind wing (transverse anal vein) vertical or nearly so, forming a right angle with An ; terminal portion of Cu of hind wing straight or very slightly curved. Occiput sharply margined. Antennae situated upon a conical elevation .... **Homonotinae Haupt**

12 (11) Vein Cut of hind wing not rectangularly joining anal vein (i. e. oblique or hook-like). Terminal part of Cu of hind wing straight, or more or less curved and always distinctly bent downward in apical third or thereabouts. .... **Pompilinae Ashmead** (*Psammocharinae* Banks)

The subfamilies of the *Pompilidae* are not very sharply defined, thus in the past several genera have been shifted from one subfamily to another. In distributing the Egyptian forms to the groups concerned I have adopted partly the standpoint of Haupt, partly that of Arnold, both famous experts at the *Pompilidae*. However, in some cases I had to depart from the system hitherto in use.

As to my opinion the subfamily *Pedinaspinae* Haupt can, owing to the pompiloid wing venation of *Pedinaspis* (especially the strongly pointed cell m3 of the fore wing, and the pompiloid terminal part of the Cu of the hind wing) only be considered a tribe of the *Pompilinae. Pseudopompilus,* which was recently (1949) referred by Haupt (as subfamily) to the Pompilidae lissoscelidae, also belongs to the *Pompilinae ;* the wing venation shows that it must come much closer to *Platyderes* than to any of the genera of the Pompilidae lissoscelidae, although it has no preapical spines on the femora, and no splayed out spines on the apex of the tibiae. In agreement with Haupt I consider the *Idopompilini* Arnold's a special subfamily rather than a tribe of the *Pompilinae,* and have, therefore, the genera *Xenaporus, Gonaporus, Microphadnus* and *Idopompilus* united in the subfamily *Epipompilinae* Haupt; the venation of the hind wing of these genera justifies this opinion. As to the *Homonotinae* I am also in agreement with Haupt ; the position of the vein Cut (transverse anal vein) of the hind wing is, besides other characters, rather unique in this group. The genus *Ctenagenia* had Haupt formerly in the subfamily *Macromerinae*, but shifted in later to the *Pompilinae* where it belongs owing to the splayed out spines of the apex of the tibiae, the only *shallow* transverse impression on sternite II, and the venation, although it has no spines near the apex of the femora in both sexes. The just named character (presence or absence of small spines in a row near the apex of the femora) was used by Haupt for dividing the family into two main groups, i.e. Pompilidae lissoscelidae and Pompilidae trachyscelidae. Unfortunately this character is not absolutely reliable, and not practical either, and can, as to my opinion, only be used in combination with other characters.

The *Ceropalinae* seem to be the most sharply defined subfamily.

In general I had to gain the impression that to the wing venation has, in more recent times, not been attributed the importance it deserved.

That venational differences are in our family perhaps less distinctly marked than in other families of the Hymenoptera tells us that the forms are very closely allied to one another, and we have to draw the consequences from this, and should not search for higher groups (subfamilies) where we do not find differences in the venation. Still, there are some differences, and they are constant, at least more so than most of the other characters which have been used for the characterisation of the groups.

In the *Ceropalinae* vein M of the fore wing always reaches the apical margin of the wing, and vein Mt3 (2nd recurrent vein) is straight or nearly so and vertical, i.e. forming a more or less right angle with M and Cu. In no other group I have seen this *combination* of characters, as the complete vein M is only seen in *Calicurgus* and *Deuteragenia* (which have, however, a curved vein Mt3); the straight and vertical Mt3 occurs in some *Ctenocerinae*, but in these vein M is always abbreviated.

In the *Pepsinae, Macromerinae* and *Ctenocerinae* which agree in their lissoscelid legs, the terminal portion of Cu (of fore wing) is more or less straight on the spot where it joins vein Cut2, i.e. cell m3 is not distinctly pointed at its base (interiorly), and the « vertical » part of Cu is slightly oblique or nearly vertical, usually fairly straight, and not strongly oblique and curved. In the *Pompilinae, Epipompilinae* and *Homonotinae,* cell m3 is pointed at base (or the « vertical » part of Cu is curved and oblique). To this character I attribute importance, and have, therefore, referred the *Pseudopompilinae* and *Pedinaspinae* as tribes to the *Pompilinae.* The former group was already considered a tribe of the *Pompilinae,* by Arnold.

Calicurgus (not Egyptian) and *Poecilagenia,* the former belonging to the *Macromerinae,* should remain there, and not join the *Ctenocerinae.* The wing venation and the shape of the ♂ antennae are certainly against the latter treatment. *Calicurgus* forms perhaps a link between the *Pepsinae* and *Deuteragenia.*

The *Epipompilinae* are a rather sharply defined group by the venation of the hind wing, i.e. the angular vein R and the basally posited vein Rt3. Though the wings of the genera of this group are in general narrower than usual, the peculiar venation has nothing to do with a possibly beginning brachypterism, since brachpterous *Parapompilus* spp., e.g., have still the evenly curved R and the more distally placed vein Rt3, as have probably all other *Ctenocerinae.*

The fact that the reduction of the radial (sc. cubital) cells was obviously acquired polyphyletically, i.e. that the genus *Evagetes* (s. lat.) developed from *Pompilus* (s. lat.), or *Telostegus* from *Protelostegus,* does not diminish the value of the venation as a means for differentiating higher groups, since we know from other families of the Hymenoptera (cf. *Eucera* and *Tetralonia* of the *Apidae*) that the veins Rt (formerly cubital transverse veins) are more unstable than others. That the wing venation represents a really important sum of characters can be seen from the fact that the sexes of one speceies always agree in this respect even in small details (e.g. shape of the more variable radial cells), as Haupt has repeatedly stated already, while most of the other characters to which so much importance has been attributed, vary to a much greater extent, and the sexes may differ in this respect (e.g. shape of prothorax, head and its parts, propodeum, spines, etc.) considerably. Shape and size of the body and its appendages, etc., may change enormously through changes in the life habits or the environment, but not so much so the wing venation. I consider, therefore, the wing venation to be the most reliable means for recognizing the *natural* relationships in this like in other groups of insects.

SIMPLIFIED KEY TO THE GENERA OCCURRING IN EGYPT

Females

1 (2) Medial vein of fore wing attaining margin of wing. Pterostigma comparatively large. Eyes reniform. Abdomen mostly short, sternite II without transverse furrow. Fore tarsi of female without comb spines, of male having ultimate joint of fore legs with preapical notch within. Antennae stout, not much curved in both sexes. Body black or ferruginous, with yellow or whitish markings. (*Ceropalinae*) .... **Ceropales Latr.**

2 (1) Medial vein of fore wing not fully reaching margin. Eyes not or less distinctly reniform. Antennae of female convoluted after death. Last joint of fore tarsi of male without interior notch or incision.

3 (18) Apex of hind tibiae with weak and short, straight backwardly directed spines. Apex of hind femora without dorsal preapical spines. Cell m3 of fore wing not pointed at interior basal angle.

4 (11) Hind tibiae serrate or with *dense* row of spines at exterior margins. Nervulus (Cut1) distinctly postfurcal. Abdomen not petiolate. Sternite II of abdomen with transverse, incised furrow. Apex of

abdomen more or less densely pilose (*Pepsinae*).

5 (6) Claws with two teeth interiorly. Cell m2 of fore wing with pale basal spot. Antennae of male rather stout. Subcostal cell elongate. Suggesting a large *Cryptochilus* .... **Hemipepsis Dhlb.** (*Mygnimia* Shuck.)

6 (5) Claws bifid or unidentate.

7 (8) Claws bifid. Antennae stout. Stigmal tubercles on propodeum conspicuous .... **Cyphononyx Dahlb.**

8 (7) Claws dentate. Antennae more slender. Tubercle in front of propodeal stigma not very conspicuous.

9 (10) Cell sc blunt at apex, vein R apically strongly curved towards costa. .... **Cryptochilus Panz.**

10 (9) Cell sc pointed at apex, radius little curved apically .... **Priocnemis Schdte.**

11 (4) Hind tibiae with only a few scattered, inconspicuous spines at exterior margins or nearly smooth. Nervulus interstitial or little postfurcal. Wings often with dark transverse bands. Species of moderate to small size.

12 (13) Only one recurrent vein (Mt2) present in fore wing. Abdomen sessile. Antennae shorter and stouter. Very small (4 mm.) species with pale ferruginous thorax, femora and tibiae .... **Micraporus nov.**

13 (12) As usual, 2 recurrent veins (Mt2 and Mt3) present. Abdomen at base more or less distinctly petiolate. Antennae very slender (*Macromerinae*).

14 (15) A distinct beard, composed of stiff and long bristles is not present either on the mentum or on the maxillary cardines. Mentum glabrous. Propodeum strongly sculptured, coarsely or finely *reticulate*. Clypeus rather flat, semicircular. Propodeum posteriorly at the sides with pale pubescence and in addition with white raised hairs .... **Poecilagenia Kohl**

15 (14) A beard of stiff bristles present either on the mentum or the maxillary cardines. Propodeum without raised hairs, posteriorly.

16 (17) Beard single, inserted on mentum. Face dull. Postnotum well developed. .... **Pseudagenia Kohl**

17 (16) Beard divided, each half arising from the base of the maxillary cardines, composed of numerous, long, inwardly curved bristles. Postnotum much reduced or linear .... cf. *Deuteragenia* Sustera

18 (3) Apex of hind tibiae (apart from calcaria) with a few more or less conspicuous, somewhat obliquely erect or splayed out spines. Exterior margins of tibiae usually with at least a few conspicuous spines which are never set in a very dense row. Hind femora often

(in most cases in the male) with a few short semierect spines (or their pores) near apex above. Cell m3 of fore wing in nearly all cases pointed at the lower basal angle. Terminal part of Cu of hind wing little curved in basal two-thirds, but (sometimes abruptly) so in apical third, or straight.

19 (64) R of hind wing curved, not angularly bent or broken near base (Figs. 3 and 4).

20 (21) Vein Cut of hind wing straight, *vertical* (a true transverse vein), prefurcal. Propodeum slightly excavated posteriorly, pointed on either side. Occiput sharply margined, head cap-like attached to pronotum. Smaller forms (*Homonotinae*) ...... **Homonotus Dahlb.**

21 (20) Vein Cut of hind wing oblique or curved hook-like, or slightly S-shaped.

22 (57) Three radial cells preseent.

23 (24) Antennae (of male, female unknown) widened towards apex, elongate-club-shaped. Fore tarsi (also in the male) with conspicuous comb of spines (Fig. 28). Abdomen much elongated. Body very densely clothed with decumbent whitish grey pubescence. Tibiae and apex of femora practically without raised spines, at lateral margin .... **Chionopompilus nov.**

24 (23) Antennae normal. Fore tarsi of male usually without comb spines, or with inconspicuous spines. Hind tibiae always with at least a few semierect spines at exterior margin.

25 (28) Occiput sharply margined.

26 (27) Very small form (3 mm.). Antennae yellow, evenly slender. Colour pale brown. Pterostigma very large, cell sc large. Abdomen shorter than thorax (Male) .... **Micropompilus nov.**

27 (26) Body stout and heavy. Margin of vertex incised medianly. Ocelli nearly in a straight line. Propodeum posteriorly strongly excavated, densely whitish pilose and thus much contrasting with the remaining body .... **Pseudopompilus Costa**

28 (25) Occiput more or less declivous, without very sharp margin.

29 (46) Propodeum more or less evenly convex, declivous portion not broadly excavated, hind angles seldom somewhat pointed.

30 (31) Clypeus (in Egyptian forms) flattened dorsally, sides mostly parallel, anterior margin truncate, *surface smooth, shining*. Scape slightly curved. Head and thorax with raised pilosity. Fore tarsi of female without comb. Eyes narrow .... **Pedinaspis Kohl**

31 (30) Clypeus not as indicated above.

32 (33) Apical tergite of female abdomen with numerous semierect *stiff* bristles on its surface (not only at the margins). Comb of claws

consisting of numerous, densely set bristles. Claws of female dentate, of male bifid .... **Anoplius Duf.**

33 (32) Apical tergite with only a few weak bristles or bare. Comb of claws mostly consisting of only a few weak setae.

34 (39) Claws bifid in both sexes (Fig. 6).

35 (36) Pronotum, propodeum and 1st tergite (at base) in both sexes with adpressed, shiny, squamiform hairs besides the normal pubescence. Postnotum at both sides of middle somewhat widened arch-like. Body usually with red or yellow markings. Fore tibiae at exterior margin with some irregularly placed, fine, short spines. Vein Cut of hind wing strongly curved and reflexed, postfurcal. Wings, at rest, often folded lengthwise. .... **Episyron Schdte.**

36 (35) Body without shining squamiform hairs and without yellow or ferruginous markings.

37 (38) Wings not folding longitudinally. Cu of fore wing ending far from apex. Abdomen without bands of pale pubescence. Prothorax little narrowed towards apex. Habitus of *Pompilus* ... **Schistonyx Sauss.**

38 (37) Wings folding lengthwise. Cu of fore wing reaching apical margin. Abdomen with narrow grey bands of pubescence on segments I-IV. Slender form, habitus of *Telostegus*. Prothorax much narrowed anteriorly. .... **Protelostegus nov.**

39 (34) Claws (of female) dentate or simple, or only fore claws bifid.

40 (41) Vein Cut of hind wing (transverse anal vein) very strongly postfurcal. Claws of fore legs of female bifid, of middle and hind legs dentate. (wings and abdomen with metallic blue shine, antennae orange to black). .... **Batozonellus Arnold**

41 (40) Vein Cut of hind wing not strongly postfurcal. Claws of female dentate of nearly simple.

42 (43) Propodeum somewhat flattened posteriorly. Fore tarsi comparatively short, hind tarsi (in Egyptian form) little longer than tibae. Claws of male bifid, of female dentate, but tooth short and slightly directed forward. .... **Anospilus Haupt**

43 (42) Not the above characters combined.

44 (45) Body densely clothed with thick decumbent hairs. Cell r3 of fore wing narrow or pedicellate (Figs. 16 and 17). Wings with sharply defined black apical spot. Postnotum very short. Cheeks long. Propodeum with slight impression posteriorly. All claws simple or very indistinctly dentate. Small species .... **Leuchimon Haupt**

45 (44) Body clothed with more or less dense pruinose pubescence. Claws dentate (seldom simple) in both sexes (only interior fore claw of male mostly bifid). Size varying. ....**Pompilus F. (s. lat.)**

46 (29) Propodeum, if convex, excavated at the declivous portion, or hardly convex and with pointed hind angles. Claws dentate, bifid or simple.

47 (52) Fore tarsi of female with long comb of spines. Pterostigma small.

48 (49) Propodeum little convex, produced on either side into a blunt or pointed cone, not very conspicuously excavated at the declivity. Body without conspicuous raised hairs. Abdomen with lateral spots or complete bands of greyish pubescence at the hind margin of some tergites. Postnotum short. Claws dentate or bifid. .... **Pompiloides Rad.**

49 (48) Propodeum with only very blunt productions above hind angles, in the middle of the declivity more or less impressed.

50 (51) Antennae long and slender. Comb of tarsi long. Ground colour of abdomen black. Claws dentate or simple in both sexes. Large species .... **Dicyrtomellus Guss.**

51 (50) Antennae short and stout. Tarsal comb moderately long. Abdomen partly red (in Egyptian species) .... cf. *Pompilus* subg. *Sophropompilus* How.

52 (47) Fore tarsi of female without comb, or with inconspicuous comb.

53 (54) Third radial cell (cell r3) pedicellate or narrow above. Male with curved antennal joints and a tuft of hairs on the declivous part of the propodeum or also on the postscutellum. **Paracyphononyx Grib.**

54 (53) Not the above characters combined. 3rd cubital cell never petiolate. Excavation of propodeum sharply margined.

55 (56) Sides of pronotum parallel, abruptly narrowed near fore margin. Claws of female dentate, of male bifid. Mandibles bidentate. Clypeus convex, more than twice as broad as long. 2nd sternite of abdomen without furrow .... **Paraferreola Sustera**

56 (55) Sides of pronotum converging anteriorly. Claws bifid in both sexes. Temples well developed, eyes slender. Clypeus flattened, less than twice as wide as long. Mandibles tridentate. 2nd sternite with curved transverse furrow .... **Platyderes Guérin**

57 (22) Only two radial cells present.

58 (61) Claws bifid. Wings folding lengthwise. 2nd radial cell trapezoidal (Fig. 29). Pubescence very finely pruinose. Thorax more or less strongly convex. Tibiae with long and stout spines. Medialis of hind wing vertical at base or even more strongly curved (hooked).

59 (60) Antennae of male simple .... **Telostegus Costa (s. str.)**

60 (59) Antennae of male serrate...... **Telostegus subg. Telostegoides nov.**

61 (58) Claws dentate or simple.

62 (63) Pronotum long, parallel-sided, depressed. Body slender, flattened dorsally, bethyloid. 1st antennal joint (scape) flattened. Fore

femora enlarged. Basal vein of fore wing curved. Apex of vein Cu of hind wing very little curved .... **Aporus Spin.**

63 (62) Pronotum not abnormally long, nor flattened. Scape as in *Pompilus*. Basal vein of fore wing straight or nearly so. Legs normal. Cu of hind wing more strongly curved in the apical third of its terminal portion .... **Evagetes Lep. (s. lat.)**

64 (19) R of hind wing broken near base, forming a pointed or right angle (Fig. 30), strongly oblique, as long as or longer than basal part of R (basad to angle). Cell r2 of fore wing mostly more triangular than trapezoidal.

65 (66) Basalis of fore wing (M + Mt1) angularly S-shaped. Propodeum posteriorly longitudinally striate, rather slender behind. Comb of anterior tarsi very short, comb of pulvillus inconspicuous. Body blackish. .... **Microphadnus Cam.**

66 (65) Basal vein not distinctly angular in the middle. Propodeum not longitudinally striate.

67 (68) Claws bifid (Fig. 7). Fore tarsi of female with long comb. Body densely clothed with decumbent pubescence. Nervulus about interstitial .... **Gonaporus Ashm.**

68 (67) Claws dentate or simple.

69 (70) Prothorax in front not widened laterally. Fore tarsi of female with long comb. Body and legs partly or wholly ferruginous, densely clothed with adpressed pubescence. Nervulus about interstitial .... **Xenaporus Ashm.**

70 (69) Prothorax anteriorly at the sides distincly widened, and the margins reflexed. Fore tarsi of female without comb. Body and legs black, with only fine pruinose pubescence on dorsum. Nervulus (Cut1) postfurcal .... **Idopompilus Kohl**

Males

1 (16) Hind tibiae without splayed out spines at apical margin. Hind femora above near apex without minute spines.

2 (9) Hind tibiae at exterior margin densely set with rows of spines, or rows of spine-bearing chitinous scales. Nervulus (Cut1) distinctly postfurcal.

3 (4) Antennae stout. Cell sc long, slender, nearly parallel-sided. Claws with two teeth within, the 1st of which is blunt . **Hemipepsis Dhlb.**

4 (3) Antennae often slender. Cell sc slightly curved below. Claws with one tooth within or bifid.

5 (8) Claws dentate. Antennae slender. Prothorax without conspicuous calli.

6 (7) Cell sc less pointed at apex, R slightly curved. Pronotum and propodeum sometimes much elongated. .... **Cryptochilus Panz.**

7 (6) Cell sc sharply pointed at apex, R less curved. **Priocnemis Schdte.**

8 (5) Claws bifid. Antennae stout. Prothoracic calli sharply defined. Stigmal cornicles on propodeum prominent .... **Cyphononyx Dhlb.**

9 (2) Hind tibiae having margins smooth, Without noticeable spines.

10 (11) Fore wing with only one recurrent vein (Mt2). Very small form (3 mm.) with stout antennae and sessile abdomen **Micraporus nov.**

11 (10) Fore wing with two recurrent veins. Abdomen sometimes petiolate.

12 (15) Abdomen petiolate, elongate. Body without yellow markings. Antennae slender. Ultimate joint of fore tarsi symmetrical.

13 (14) Prothorax and propodeum with noticeable erect pilosity, the latter (propodeum) with coarser sculpture. Vertex smooth and shining. Striae on postnotum oblique .... **Poecilagenia Haupt**

14 (13) Body without raised hairs. Head dull. Striae of postnotum transverse. .... **Pseudagenia Kohl**

15 (12) Abdomen short, broadly sessile. Body black or ferruginous with yellow or whitish markings. Antennae short and stout. Fore tarsi with pre-apical incision or notch within. Medialis of fore wing reaching margin ; second recurrent vein (Mt3) vertical, nearly straight .... **Ceropales Latr.**

16 (1) Hind tibiae (besides calcaria) with a few splayed out spines at apex. Near apex of hind femora in most cases a few semi-erect spines.

17 (18) Antennae distinctly widened towards apex, slender, clubshaped. Fore tarsi with long comb (male). Body with very dense pale grey pubescence .... **Chionopompilus nov.**

18 (17) Antennae attenuated towards apex or of even width, or serrate, or the segments singly curved.

19 (20) Antennae slightly serrate. Wings with milky white shade. 2 radial cells. .... **Telostegus subg. Telostegoides nov.**

20 (19) Antennae not serrate, but sometimes the single joints bent.

21 (24) Segments of antennae curved, each one obliquely inserted.

22 (23) Transverse anal vein of hind wing (Cut) very strongly postfurcal. Similar to *Episyron* .... **Batozonellus Arn.**

23 (22) Body without yellow markings, but often with gray bands or spots on some tergites. Postscutellum and propodeum with short, raised, felty tomentum. .... **Paracyphononyx Grib.**

24 (21) Antennae normal, the segments not singly curved or very indistinctly so, or sometimes a little obliquely inserted.

25 (26) Very small form (3 mm.). Antennae fine, wholly yellowish, filiform. Body pale brown. Pterostigma very large, cell sc large. Vertex

sharply margined posteriorly .... **Micropompilus nov.**

26 (25) Not the above characters combined.

27 (28) Thorax black, propodeum with conspicuous dense silvery white pilosity, broadly emarginated posteriorly, surrounding base of tergite I. Wings with broad dark band. Body heavy, antennae comparatively short. Occiput rather sharply margined .... **Pseudopompilus Costa**

28 (27) If the occiput is sharply margined, the propodeum has no dense silvery white pilosity.

29 (30) Occiput very sharply margined, excavated so that the head is attached cap-like to the prothorax. Transverse anal vein (Cut) of hind wing vertical or nearly so. Small species. .... **Homonotus Dahlb.**

30 (29) Head not attached cap-like to prothorax. Transverse anal vein oblique or arch-like joining Cu.

31 (34) 1st antennal joint slightly curved, sometimes somewhat flattened. Prothorax sometimes elongate. Eyes comparatively slender.

32 (33) 3 radial cells present. Head and thorax with raised black pilosity (difficult to separate from *Pompilus*) .... **Pedinaspis Kohl**

33 (32) 2 radial cells present. Prothorax rather elongate. Fore femora enlarged. .... **Aporus Spin.**

34 (31) 1st antennal joint straight, sides more convex.

35 (54) 3 radial cells present.

36 (47) Claws bifid.

37 (38) Prothorax (anteriorly), propodeum and 1st abdominal tergite (at base) besides the pruinose ground-pubescence, with easily rubbed off silvery (or golden) squamiform adpressed hairs. Body mostly with pale markings. Vein Cut of hind wing strongly curved at apex. Wings often folding longitudinally. .... **Episyron Schdte.**

38 (37) Without squamiform hairs, or they cover the whole body.

39 (42) Propodeum excavated posteriorly.

40 (41) Clypeus convex. Mandibles bidentate .... **Paraferreola Sust.**

41 (40) Clypeus flattened, large. Mandibes tridentate ... **Platyderes Guérin**

42 (39) Propodeum not strongly excavated posteriorly, sometimes somewhat flattened dorsally.

43 (44) Wings folding lengthwise. Body very slender, tibiae spinose. Cu of fore wing reaching apical margin. Habitus of *Telostegus*. .... **Protelostegus nov.**

44 (43) Wings not folding. Cu of fore wing not attaining margin. Tibiae less spiny.

45 (46) Abdomen slender. Abdomen black, with grey basal bands of pruinose pubescence, or black and red .... **Anoplius Duf.**

46 (45) Abdomen less slender. Body black or dark brownish, inner orbits pale. Vein Rt2 of fore wing sometimes obliterated. .... **Schistonyx Sauss.**

47 (36) At least middle and hind claws dentate or simple, not bifid (²)

48 (51) Pterostigma very small.

49 (50) Head, 1st antennal joint and propodeum with raised pilosity. Abdomen (of Egyptian species) black .... **Dicyrtomellus Guss.**

50 (49) Without raised pilosity. Abdomen with greyish apical spots or transverse bands of pubescence on the tergites ..... **Pompiloides Rad.**

51 (48) Pterostigma normal or large.

52 (53) Claws dentate or simple. Cell r3 normal or seldom higher than long, in this case body not with very dense pale pilosity .. **Pompilus F.**

53 (52) Claws simple. Small species with dense adpressed greyish yellow pilosity. Cell r3 narrow (high) or petiolate. Postnotum densely transversely pilose. Cheeks long .... **Leuchimon Haupt**

54 (35) 2 radial cells present.

55 (60) R of hind wing curved, not broken near base.

56 (57) Claws bifid. Wings folding lengthwise, cell r2 trapezoidal. Tomentum pruinose .... **Telostegus Costa**

57 (56) Claws dentate or simple.

58 (59) Prothorax comparatively long. Fore femora incrassate. 1st. antennal slightly curved. Body somewhat flattened, bethyloid .... **cf. Aporus Spin.**

59 (58) Prothorax normal, much broader than long. Fore legs not incrassate. Like *Pompilus* .... **Evagetes Lep.**
(incl. *Tachyagetes* Haupt)

60 (55) R of hind wing broken near base, shorter than vein Rt3.

61 (62) Claws bifid .... **Gonaporus Ashm.**

62 (61) Claws simple or dentate.

63 (64) Basalis of fore wing angularly S-shaped. Propodeum posteriorly longitudinally striate. Body blackish ....**Microphadnus Cam.**

64 (63) Basalis of fore wing not broken. Propodeum not striate.

65 (66) Body and legs partly or wholly ferruginous, densely clothed with adpressed pubescence. Nervulus about interstitial .... **Xenaporus Ashm.**

66 (65) Body and legs black, with only fine, pruinose pubescence, dorsally. Nervulus (vein Cu1) postfurcal .... **Idopompilus Kohl**

(²) In *Anospilus* Haupt and the subgenus *Pareiocurgus* Haupt (in. litt.) of *Pompilus* the males have a somewhat backwardly directed tooth.

I. Subfamily CEROPALINAE Ashm.

Genus CEROPALES Latr.

The venation of this genus (and subfamily) is characterized by the veins M and Cu of fore wing both of which attain the apical margin of the wing, and at the same time by the vertical transverse vein Mt3 that is straight or nearly so. The venation of the hind wing is normal with analis always surpassing Cut1 and the latter being oblique. Antennae stout, never convolute after death. The ultimate tarsal joint of the male has a notch or incision of varying size (according to species) within. Hind femora near apex in both sexes with irregularly placed minute spines. Claws of posterior tarsi subrectangularly bent at apex. Labrum large. Eyes more or less reniform. Apex of propodeum without distinctly raised margin. Second abdominal sternite without transverse furrow. Sixth sternite of female folded, imitating an ovipositor. Body black or red, with yellow markings.

All Egyptian species have, like the European species: ***variegatus*** F., *cribratus* Costa and *albicinctus* Rossi, no rows of small spines on the under side of the ultimate tarsal joint, while *C. maculatus* F. has such spines.

Key to Egyptian species

1 (4) Abdomen yellow, segments at base more or less extensively ferruginous. Legs ferruginous with yellow markings.

2 (3) Head (of female) dull, alutaceous, with few shallow larger punctures. Antennal joint 1 nearly straight at exterior margin, and only moderately rounded interiorly. Frons without pale spot below 1st ocellus. Antennal tubercle black or with yellow dot. Mesonotum dull with shallow larger punctures. Only middle tibiae lined with yellow exteriorly, hind tibiae at most with yellow basal spot. Abdominal tergites red, more or less broadly margined behind with ebony-white. Coxae with yellow line exteriorly. Pterostigma yellow, margins dark .... **opacior spec. nov.**

3 (2) Head around ocelli and at their sides smooth, shining, with a few coarse punctures. Antennal joint 1 shorter, scarcely longer than broad, strongly, nearly semicircularly rounded within (as in *C. honorei*). Yellow spots present in front of anterior ocellus, and in the excavations of the eyes. Antennal tubercle yellow. Mesonotum shining, with coarser punctures. Middle and hind tibiae ferruginous, lined with yellow exteriorly. Abdominal segments nearly wholly yellow exteriorly, only segment I at base more or less extensively orange, II at base (sometimes only at middle), III sometimes orange at base. Coxae more extensively yellow exteriorly. Vein Sc+R+M

and pterostigma straw-yellow. Small males have legs nearly black, middle tibiae at base and apex exteriorly yellow, hind legs dark, calcaria pale. .... **deserticola spec. nov.**

4 (1) Abdomen black, marked with ivory-white or deep yellow, especially postero-marginal bands of abdominal segments of that colour.

5 (6) Larger species (8.5 mm.). Antennae and legs ferruginous, only 1st and 2nd antennal joint, dark above. Abdominal tergites with narrow, uninterrupted, apical bands. Stigma and all veins black, only costa ferruginous at base. Head and thorax dull .... **albicinctus Ro. f. croceipes nov.**

6 (5) Smaller species (3.5-6 mm.). Antennae wholly or for the greater part dark.

7 (8) Head finely and densely punctured so that it appears alutaceous under lower magnification, with some larger shallow punctures, in any case, *frons in front of ocelli dull,* only the vertex slightly shining. 1st antennal joint longer than broad, slightly rounded towards apex. Mesonotum dull, somewhat more densely (especially towards base) set with punctures of unequal size. Femora dark red, middle and hind tibiae darkened, *hind legs without yellow markings,* middle tibiae with yellow basal and mostly also yellow apical longitudinal spot. Yellow bands of abdomen narrowed or slightly interrupted at middle. All veins and pterostigma blackish. . **sabulicola spec. nov.**

8 (7) Head (under high magnification) densely and finely punctured, shining. 1st antennal short, nearly semicircularly rounded within. Veins (except the dark Sc+R+M) straw-yellow at base of wing, pterostigma and outlines of it yellow or yellow-brown.

9 (10) Mesonotum slightly shining with some larger punctures. Middle and hind femora and tibiae ferruginous, the latter lined with yellow exteriorly, hind tibiae with yellow basal spot. Yellow bands of tergites broad, not interrupted at middle, at both sides deeply incised with black (dot-like so). .... **honorei spec. nov.**

10 (9) Very small form (3.3-3.5 mm.). Head and mesonotum strongly shining, without larger punctures. Head black, only the mandibles, 1st antennal beneath and fore margin of clypeus yellowish. Femora dark brown, apices pale, tibiae brownish, paler at base, fore and middle tibiae yellow at exterior margin. Excavations of yellow bands of tergites slighter than in *honorei.* .... **tihensis spec. nov.**

Ceropales opacior spec. nov.

1812. Unnamed, Savigny, Descr. d'Egypte, pl. 18. fig. 20.

Female: Length 5-6 mm. — Black, red and yellow. *Black* are the following parts: Frons (above) and vertex, prothorax anteriorly at the declivity, scutum for the major part, sides of scutellum and postscutellum, propodeum anteriorly and medianly. *Yellow* are: Frons below, labrum and clypeus, excavations of eyes, the posterior orbits, antennal calli (sometimes), 1st and 2nd antennal joint beneath, hind margin of prothorax, median line (posteriorly) and lateral margins of scutum, raised parts of scutellum and postscutellum (base of the former sometimes dark), hind angles of the propodeum, sometimes up to middle, *broad and full apical marginal bands* of the tergites, the exterior of fore and middle tibiae and metatarsi, as well as a spot on the femora exteriorly. *Red* are: Antennae at base and beneath or wholly, legs (except the above named yellow lines) and the abdomen (except the yellow apical bands). *Wing veins dark,* also the outlines of the pterostigma, and the costa.

Head dull, alutaceous, with a few shallow larger punctures, with fine silky pubescence. Upper distance of eyes compared with lower one (between antennae) = 23:13. Mesonotum of the same sculpture as the head. The yellow border of the pronotum not quite smooth, but finely alutaceous and pubescent. Propodeum finely sculptured, with fine silky pubescence. Vein Rt 3 slightly S-shaped. 1st antennal straight exteriorly, slightly convex interiorly, somewhat longer than broad.

Habitat: 2 females, Gabal Asfar 1.v.29 and 18.vii.37 (leg. Alfieri).

Ceropales deserticola spec. nov.

Female: 4.5-5 mm. — In the coloration of the abdomen similar to the former species, but the yellow colour still more prevalent so that almost only the base of the 1st tergite remains red. *Black* are: Frons above and vertex, antennae from joint 3 onwards dorsally, scutum, sides of scutellum and postscutellum, propodeum in the middle, chest for the major part. *Yellow* are: Anterior part of head, excavations of eyes, a transverse spot below ocelli, antennal calli, under side of antennals 1 and 2, margin of vertex, prothorax, a median spot on the scutum, and the lateral margins of it, median part of scutellum and postscutellum, sides and hind margin of propodeum, abdomen (for the major part), coxae beneath or wholly, *all femora and tibiae* which are red only on the upper side. Tarsi as in the former species, brownish towards apex. *Wing veins dark, but costa and pterostigma testaceous.*

Distance of eyes on vertex compared with that between antennae = 20:13. Antennae about as long as the thorax, 1st joint short, interiorly (as in *honorei*) semicircularly rounded, scarcely longer than broad. Scutellum shining, with some coarser punctures. Propodeum, as in the other species, finely sculptured. Vein Rt3 less curved. *Wing veins dark, but costa yellow-brown,* *like the pterostigma and its outlines.* Claws dentate, tooth slightly directed forward in the male, the latter is similar to the female, having also the same sculpture. Antennals 1 and 2 may be wholly yellow. Veins and stigma of the same colour as in the female. Hind tibiae sometimes lined with yellow only at base.

This species differs from the foregoing one, apart from the different coloration, in having the head around ocelli almost smooth and shining, having smooth and shining raised posterior margin of the prothorax, shining scutum, which is not or scarcely alutaceous and has only a few large punctures.

Habitat: Males and females; Kerdasa, Manchiet Radwan, Beni Yousset, Fayoum, Wadi El-Tih, Wadi Gerawi, Wadi Assiouti (coll. Min. Agric., Alfieri, Mochi, Priesner). Males iv-vi, ix; females iv-vi, ix, x.

Ceropales sabulicola spec. nov.

Female: 5-6 mm. — Black; ferruginous are the legs with the exception of the pale yellow exterior sides of the fore tibiae and metatarsi, small spots on apices of fore and middle femora. Hind tibiae above and tarsi blackish. Middle tibiae, as usual, with yellow basal and apical spot exteriorly. *Yellow* are, besides, anterior part of head up to the antennae, the excavations of the eyes, 1st and 2nd antennal joints beneath, anterior angles and posterior elevated margin of prothorax, the postscutellum at middle, the hind angles of the propodeum, and the narrow, medianly mostly interrupted postero-marginal bands of the abdominal segments I-V; segment VI wholly yellow.

Distance of eyes on vertex in comparison with that between antennae = 21-23:10-11. Frons and vertex for the major part dull, alutaceous, with scattered, larger punctures. Mesonotum alutaceous as well, with numerous coarse punctures. *Wing venation and pterostigma dark.*

Habitat: ii-ix and xi, Megadla, Manchiet Radwan, Abu Rowash, Sakkara, Fayoum, Helwan, Wadi Hof, Gabal Asfar, Abu Zabal (coll. Alfieri; Min. Agric.)

Ceropales honorei spec. nov.

Female: 3.5-6 mm. — Black; red coloured are: The legs, except the dark coxae and the exteriorly yellow-lined fore and middle tibiae and metatarsi, a yellow spot on the apices of the femora exteriorly, and a similar one on the hind tibiae. Yellow are: Anterior part of head, 1st and 2nd antennal joints beneath, small spots in the excavations of the eyes, an anterior spot on the pronotum and the thick hind margin of it, the postscutellum, the hind angles of the propodeum, and broad, medianly not interrupted, postero-marginal fasciae of the tergites which are laterally more strongly notched than in *sabulicola.* Segments 5 and 6 wholly or nearly wholly yellow.

Head distinctly shining and very finely and densely punctured. Distance of eyes on vertex compared with that between antennae = 21:15-16. The 1st antennal joint is interiorly very strongly rounded, and as in *deserticola,* not longer than broad. Mesonotum shining, densely and finely punctured, with sparse coarse punctures. Scutellum shining, very densely and finely punctured, with indistinct coarse and shallow punctures. Wing veins at base (except the darker vein Sc+R+M) straw-yellowish, costa and pterostigma yellow, the latter only at extreme tip brownish, since cell sc is surrounded with brown. Vein Cut1 distinctly prefurcal. Very small females are more strongly shining, and the puncturation is less dense. Head black, only clypeus yellow anteriorly. Stigma brown at the whole hind margin. Tooth of claws very small in both sexes.

Male: 3.5-5.5 mm. — Coloration and sculpture as in the female, the pale abdominal bands on tergites IV-VI narrowed in the middle.

Habitat: The species was found from i-v and x., xi. at Abu Rowash, Kerdasa, Kafr Hakim, Beni Youssef, Helwan and on the Suez Road (coll. Min. Agric. and Alfieri).

Ceropales tihensis spec. nov.

Female: 3.3 mm. — Wholly black, shining. Whitish yellow are only the fore and lateral margins of the clypeus, labrum and mandibles, 1st antennal joint beneath, hind margin of prothorax and the postscutellum: a very small yellow spot at the hind angles of the propodeum. Yellow to pale ferruginous are the extreme tips of the femora, base, apex and an exterior line on middle and hind tibiae, and the extreme tip of the coxae. The basal tarsal joints yellowish, on the hind tarsi only the 1st joint so. The narrow postero-marginal bands of the abdominal tergites are yellow, with black sinuations on either side, that are broader than in *honorei.* The silvery pubescence is very scarce, more conspicuous only on propodeum and 1st abdominal segment. Frons without yellow design.

Antennae thickened, 1st joint as in *honorei* short, strongly rounded interiorly, not longer than broad. Head shining also in the space between base of antennae and anterior ocellus, only extremely finely punctured, without larger punctures. Mesonotum shining, very finely punctured, with scarcely noticeable larger punctures. Wing veins testaceous, pterostigma pale yellow, brownish at margins, vein Sc+R+M dark.

Habitat: 1 female, Wadi El-Tih, 20.iv.1934, leg. H. Priesner.

Ceropales albicinctus Rossi f. croceipes nov.

Male: 8.5 mm. — Black, antennae and *the whole legs* with trochanters ferruginous, coxae black at base. The antennae have only joints 1 and 2 shaded with brown above. Inner orbits broadly, outer orbits only above, narrowly yellow, frons below antennae, clypeus and labrum yellow; head anteriorly with three black dots or short lines: hind margin of prothorax broadly yellow, lateral calli in front, scutellum at middle posteriorly, a lateral posterior spot on the propodeum and complete posteromarginal bands on the abdomen yellow (the yellow colour has probably become somewhat orange through the action of cyanide). Wings slightly shaded, with dark veins and stigma.

Vertex slightly shining, frons dull, both finely aciculated, with scattered coarse punctures. Pubescence quite inconspicuous. Scutum dull aciculated, with coarser punctures. Postnotum posteriorly not triangular at middle. Propodeum dull, very finely aciculated, with coarse, shallow punctures, without distinct roughening. Abdomen shining, finely sculptured. Nervulus (Cutl) interstitial, vertical. Transverse anal vein (Cut1) somewhat curved, joining analis in an interiorly very blunt angle, Cu in a pointed one, prefurcal. Cell r3 of fore wing above half as long as below, vein Rt3 curved, strongly so at base (apex of abdomen destroyed).

Though the unique specimen is mutilated I had to describe it, because it belongs to a species entirely different from these described above, and because it is still in fairly good condition.

Differing from *C. albicinctus* Rossi only in its coloration, in having the whole antennae, the tibiae and tarsi ferruginous, while *albicinctus* has at least the hind tarsi wholly, and the tibiae at their apices, blackened. The dark spots on the head also occur in the typical European *albicinctus*.

Habitat: 1 male, Amriah (Mariout), 14.vi.1935, leg. M. Kassim (coll. Min. Agric.).

A comparison with the species described by Arnold from Middle and South Africa shows that none of them is identical with the Egyptian species, though I have to remark that *C. sabulicola* must be rather similar to *C. kriechbaumeri* Magr. The pale (ferruginous) species are different from similar ones of Arnold's by the body sculpture, from *pictus* Arn., besides, by the quite different distribution of the colours. *C. kriechbaumeri* has, as compared with *sabulicola*, a spot on the supra-antennal tubercle, a small round spot on the scutellum, yellow spots on the base and apex of the hind tibiae, and straw-yellow posterior metatarsus. As I have seen a series of specimens of *sabulicola*, none of them showing these characters, I doubt the identity of the two species, and prefer therefore to give our form a special specific name, until a comparison of specimens will be possible.

Haupt described (in: Pompilidae Palästinas, MS.) 5 new species from Palestine. I am surprised to find none of the Egyptian species identical with those of Haupt, although I could only compare the colours, since Haupt has in his brief descriptions not yet given details of the sculpture and the shape of the antennal base.

II. Subfamily PEPSINAE Ashm.

Genus HEMIPEPSIS Dahlb.

(Synonyma: *Mygnimia* Shuck.; *Mygnimia* Haupt, Psamm. Europas, 1927, pp. 26, 28; *Hemipepsis* Arnold, Psamm. Ethiop. Reg., 1932, p. 318).

Hind tibiae with rows of sharp teeth. Cell m2 of fore wing with a fenestra at the base, i.e. a hyaline area enclosing an opaque spot; cell r2 much longer than high, cell r1 not much longer than r2; cell sc elongate, almost parellel-sided. Antennae of male very stout. Claws with two teeth within.

Hemipepsis brunnea (Klug)

1834. *Pompilus brunneus* Klug, Symb. phys., pl. 38. fig. 2. Male.
1871. *Priocnemis brunnea* Walker, List of Hym. Egypt, etc., p. 15.
1871. *Hemipepsis brunnea* Haupt, Pompil. Palastinas, M.S.

I only know Klug's description of this species, which runs as follows: Male: « Brown-black, head, collar and legs brown, wings ferruginous, margin brown.» .... « Head dark brown, below the antennae black, labrum and antennae ferruginous. Thorax dark brown above, collar red-brown, propodeum transversely excavated, black, hairy. Legs dark brown, coxae and femora almost black. Wings yellow, darker at base, exterior margin blackish, veins and stigma yellow. Tegulae red-brown. Abdomen unspotted, black. — Length 22-23 mm.» (From Latin).

Habitat: The original locality is Syria, but Walker records the species from Cairo. Haupt reports it from Palestine. I have not seen this species.

Genus CYPHONONYX Dahlbom

(cf. Arnold, Psamm. Ethiop. Region, pt. I, p. 291, 1932).

Hind tibiae of female with a row of spinose scales, of male with a row of fine and short spines. Antennae less stout than in *Hemipepsis*. Cell sc not paralled-sided, acute. Posterior margin of pronotum somewhat depressed. Postnotum shorter than postscutellum. Infrastigmal tubercle on propodeum large. Claws bifid. Large species.

Key to the species.

1 (2) Body wholly dark reddish black. Wings strongly infumated, but with brownish hue and darker markin. Propodeal tubercle large.......... .... **castaneus** (Klug).

2 (1) Body and wings with blue lustre. Antennae orange .. **flavicornis (F.)**

Cyphononyx flavicornis (F.)

1812. Unnamed, Savigny, Descr. d'Egypte, pl. 17, fig. 19.
1843. *Pompilus sabulosus* Guérin, *Magas. Zoologie,* XIII, p. 114, female.
1844. *Pompilus croceicornis* Erichson, Forster, Descr. Anim., p. 19.
1926. *Cyphononyx bretoni* Haupt (nec Guérin), Psammoch. Europas, p. 29.
1932. *Cyphononyx croceicornis* Arnold, Psamm. Ethiop. Reg., pt. I, p. 301, fig. 6.

Female: 18-23 mm. — Body black with blue lustre, antennae orange, joint one somewhat brownish. Head, pronotum, scutum and scutellum reddish-black, metathorax, propodeum and abdomen black with blue to dark green lustre. Legs black, also with blue. Wings very strongly infumated, strongly shining blue. Anterior body dull, abdomen slightly shining.

Head narrowed behind eyes, orbits in frontal aspect almost parallel below, narrowed above, the excavation situated near the vertex. Eye somewhat narrower than half of frons. Median sulcus in front of 1st ocellus conspicuous. Temples (laterally) two-thirds of width of eye. Ocelli forming a blunt angle; (pol): (ool) = 2:3. Antennae upon a tubercle, stout, joint 3 longer than 1+2, curved, four times as long as broad, distinctly longer than 4. Clypeus little convex, more transversely so, nearly straight in front. Temples and prosternum with black pilosity. Prothorax short, with median impression and strong calli, hind margin nearly obtusely angular. Scutum slightly elevated in the middle, margins reflexed. Scutellum and metanotum strongly convex, with raised black hairs. Postscutellum laterally smooth, transversely striate. Postnotum deepened, finely transversely striate, with median foveola, little shorter than the postscutellum. Propodeum transversely rugose, with median sulcus. Tergite I of abdomen strongly convex, steeply declivous in front, tergite II with sparse, shallow punctures, sternite II with sharply incised transverse sulcus. Apex of abdomen with dense black pilosity. Wings with basalis (M + Mt1) straight, cell sc obliquely truncate, rounded only at the extreme apex. Vein Cut of hind wing strongly semicircularly curved at apex, interstitial. Claws bifid, apical joint of tarsi in both sexes with rows of comparatively stout spines beneath; comb-spines of pulvillus stout, sparse. Anterior metatarsus with short spines all around.

Male: 11-19 mm. — Like the female, only the fore tarsi more weakly spinose. Coloration the same. Anal plate broad, slightly raised at base, margin densely set with inwardly curved hairs.

Habitat: Common in Egypt in the cultivated area, also the oases, less common in the desert.

Distribution: South Europe, Cyprus, Syria, Palestine, Ethiopic Region to South Africa.

This species may be confused by the beginner with *Batozonellus fuliginosus* var. *bretoni* Guér. which may be easily distinguished by the differently shaped prothorax, the interstitial nervulus, the strongly postfurcal vein Cut of the hind wing, the dentate middle and hind claws and the differently spinose hind tibiae.

Cyphononyx castaneus (Klug)

1834. *Pompilus castaneus* Klug, Symb. phys., Dec. 4. Taf. 38, fig. 9.

Female: 19-30 mm. — Abdomen black, anterior body dark reddish brown, legs and antennae black. Wings (as correctly illustrated in Klug l.c.) strongly shaded with brown, with a yellowish brown tint, apical margin and fore margin of cell sc black; hind wing very slightly darker than fore wing.

Eyes emarginated interiorly, about as broad as half of frons. Clypeus and labrum comparatively long, the former aciculated and with single shallow large punctures. Temples, in lateral aspect, broader than half of eye. Ocellar distance slightly less than that between hind ocelli and eye (4:5). Pronotum very short, with deep median sulcus, hind angles excavated, calli obtusely angled posteriorly, protruding. Scutellum strongly convex, *postscutellum protruding like a blunt tooth*, with dark pilosity. Postnotum shining, transversely striate, somewhat shorter than the postscutellum, deeply embedded, with distinctly visible sulcus, slightly emarginated behind. Propodeum moderately long, dull, from the strongly protruding stigmal tubercles (cf. fig. 9 of Klug), narrowed posteriorly, with conspicuous median sulcus, and coarsely transversely rugose. Abdomen broadest about at the hind margin of segment II, this segment much longer than I, with black-brown dorsal pubescence. Anal segment set with brown, inwardly curved hairs. Hind tibiae densely spinose, without chitinous scales. Cell sc long, pointed at apex, cell r3 above somewhat shorter than r2, vein Rt3 strongly curved; Vein Mt2 nearly intestitial with Rt2, vein Mt3 ending before middle of cell r3; Cu of fore wing not fully reaching apical margin. Rt3 of hind wing shorter than one-third of the basal portion of R. Cut of hind wing semicircular at apex, very slightly postfurcal.

Male: 19 mm. — Antennae not stouter than in the female, the terminal joints shallowly sulcate above so that they appear somewhat twisted in lateral aspect. Anal plate testaceous, with fine black margin, and densely set with dark inwardly curved hairs, only slightly carinate beneath, nearly semicircular in outline.

Habitat: This species was known from the Sudan and from Tripolitania. In Egypt this insect is uncommon ; it was collected at Gebel Asfar near Cairo (leg. Alfieri, Innes, Ferrante), at Abu Roash and Mansuria, from vi. to viii., and at Mersa Matrouh (T. Sayed).

Genus CRYPTOCHILUS Panzer

(Synonyma: *Salius* F., p.p.; *Stenoclavelia* Arnold, l.c., pt. II, p. 44).

Hind tibiae of female with a row of spinose scales, of male with rows of short spines. *Cell sc blunt at apex.* Antennae slender. Claws dentate. Postnotum sometimes vestigial. Infrastigmal tubercles not conspicuous or wanting. Nervulus postfurcal. Terminal joint of tarsi below with a double row of small spines that are weaker in the male. Males often much differing from females by the slender prothorax and propodeum. Claws of fore legs of male symmetrical.

Key to the species

1 (4) Wings not yellow. (Only females known).
2 (3) Wings blackish, with metallic lustre. Abdomen at base indistinctly metallic. .... **coeruleipennis spec. nov.**
3 (2) Wings slightly shaded with grey, with dark apical margin. Abdominal segments I and II ferruginous. Two yellow dots at the sides of the antennal cavities and a transverse spot on either side of the prothorax anteriorly. .... **fischeri (Spin.)**
4 (1) Wings yellow, with dark margin. Body ferruginous and black.
5 (6) Femora in both sexes wholly dark. Smaller species (female 8.6-12, male 7-8 mm.). Hind tibiae dark towards apices. Rt1 and Rt2 of fore wing strongly converging, the latter being only little oblique. Male : Hind wings with almost straight limitation of dark apex, hind margin scarcely darkened ; propodeum dull. Prothorax much broader than long. .... **minor spec. nov.**
6 (5) Apical fourth or third of femora ferruginous in both sexes. All tibiae ferruginous.
7 (16) Females.
8 (11) Temples (of female) thick, head across temples somewhat broader than across eyes. Length 16-20 mm.
9 (10) Propodeum everywhere rather evenly *transversely striate*. Hind wings at hind margin not shaded, at apical margin only narrowly so. The darkening of the margin of the fore wing does not attain apex of cell r3. Clypeus finely longitudinally striate. . **niloticus spec. nov.**

10 (9) Propodeum anteriorly right within stigmata not transversely striate, in the middle slightly, posteriorly distinctly but irregularly striate. Hind wings at hind margin, and broadly at apex, blackened. Darkening of fore margin reaching apex of cell r3. Clypeus not longitudinally striate. .... **discolor (F.)**

11 (8) Head across temples (in dorsal aspect) not broader than across eyes, but more or less narrower. Clypeus finely longitudinally striate. Length 11-16 mm.

12 (13) A spot on the middle of the tibiae black; femora ferruginous only at base. .... **cf. femoralis (Spin.)**

13 (12) Tibiae ferruginous.

14 (15) Middle and hind femora ferruginous, but in basal fourth (seldom almost third) black. Propodeum evenly transversely striate. .... **schmiedeknechti spec. nov.**

15 (14) Middle and hind femora black, in apical third or fourth red. Propodeum irregularly rugose, not transversely striate. .... **mareoticus spec. nov.**

16 (7) Males (3).

17 (22) Prothorax much broader than long. Clypeus, in lateral aspect, more or less evenly convex, with a shallow, coarse, bristle-bearing punctures in front of middle. Hind margin of hind wings more or less shaded.

18 (19) Middle and hind femora at most in basal half (usually less) black. Propodeum evenly transversely striate. . **schmiedeknechti spec. nov.**

19 (18) Middle and hind femora black, only their apical third ferruginous. Propodeum not evenly transversely striate, at most in apical half longitudinally or obliquely rugose, or smooth.

20 (21) Clypeus only about twice as broad as long, in front very slightly emarginated for all its width. Head, in dorsal aspect, somewhat narrower across the temples than across the eyes. Propodeum backward from middle with fine, oblique striae (rugae), posteriorly with fine lateral sulcus reaching to middle. .... **mareoticus spec. nov.**

21 (20) Clypeus more than twice as broad as long, in front emarginated for the whole width. Eyes and temples longer, head across temples as broad as across eyes. Propodeum somewhat shining, posteriorly only lengthwise rugose, the lateral sulcus fine, mostly only at apex somewhat more deeply incised. .... **detectus spec. nov.**

22 (17) Prothorax either as long as broad or somewhat longer than broad. Clypeus, in lateral aspect, *flattened* in front, not evenly convex, the bristle-bearing pair of punctures situated near fore margin.

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(3) I was unable to include in the key the male of *C. femoralis* Spin., since the original description does not contain the important distinctive characters.

23 (24) Smaller, more slender species. Width of thorax distinctly less than 2 mm. Hind wings scarcely shaded at hind margin. Propodeum shining ; near posterior margin, between the two median foveolae, somewhat transversely striate. .... **niloticus spec. nov.**

24 (23) Larger, width of thorax more than 2 mm. Hind wings at hind margin and at apex broadly shaded with grey. Propodeum little shining, more distinctly pilose, somewhat longitudinally striate posteriorly at middle. ....**discolor (F.)**

Cryptochilus coeruleipennis spec. nov. (⁴)

Female: 12.5-16 mm. — Head and thorax more or less dark red, abdomen black, the latter sometimes with very slight blue lustre. Wings very strongly shaded, with blue lustre. Legs black to dull red. Antennal joints 1 and 2 mostly dark reddish.

Clypeus not twice as broad as long, slightly convex lengthwise, sides strongly narrowed towards apex in a straight line, fore margin distinctly emarginated or excavated at middle, finely reflexed : clypeus, particularly at the sides, with a few shallow coarse punctures ; as a whole dull like the head. Temples, in dorsal aspect, not broader than eyes, not widened posteriorly, in lateral aspect well as broad as the eye. Eyes distinctly narrower than half of frons, orbits parallel-sided, quite indistinctly emarginated above. Ocelli small, position nearly rectangular, (pol) much smaller than (ool). Antennal joint 3 somewhat longer than 1 + 2. Pronotum posteriorly almost obtusely angled, margin distinctly separated, median sulcus deep, margin and sulcus blackened, dorsal calli conspicuous. Postscutellum short, hump-like. Postnotum only about half as long as postscutellum, or little more. Scutellum convex. Longitudinal veins of fore wing ending far from lateral margin. Veins Rt1 and Rt2 little curved, oblique, Rt3 somewhat curved. Cells r2 and r3 subequal in length, above and below. Nervulus distinctly postfurcal. Vein Cut of hind wing vertical at apex, interstitial. Propodeum strongly and evenly transversely striate, particularly so on the declivity, with median sulcus. Abdomen practically not punctured, apical segment densely pilose. The longer calcar of the hind tibiae equalling one-third of the metatarsus.

Male unknown.

Habitat: Kafr Hakim, Borg El-Arab, Amriah, Abukir, v.-vii. (coll. Soc. Ent. Eg., Cairo University, Min. Agric.).

(⁴) *Salius sanguinicollis* Saunders (*Trans. Ent. Soc. London*, 1901, p. 560) from Biskra, being no doubt similar in size and coloration, differs in having the antennae rufo-testaceous, only 2 apical joints dusky. The abdomen has a remote, rather large but shallow, puncturation, the mesopleurae are spinose above the coxae, and the propodeum is subtectiform with a central ridge.

Cryptochilus fischeri (Spin.)

1838. *Pompilus fischeri* Spinola, *Ann. Soc. Ent. France,* p. 460.

Original description: «Female. Long 4 lig. Larg. 1 lig. — Très voisine de la femelle du *Pomp. fuscus,* dont on la croirait une variété. Elle en diffère d'abord par une petite tache blanche, de chaque côté sur le prothorax, et par les genoux, tarses et tibias de la première paire de pattes, de la même couleur. Toutes ces parties sont ordinairement noires dans le *Pomp. fuscus.* Ces légères différences sautent les premières aux yeux. En voici quelques autres, moins apparentes, mais auxquelles j'attache un peu plus d'importance. Dans les deux espèces, le métathorax est ridé transversalement. Mais dans le *fischeri* les rides sont également visibles sur tout le dos. Dans le *fuscus,* elles ne sont réellement marquées qu'en arrière et sur les côtés. Dans le *fischeri,* le bord antérieur de la seconde cubitale est plus court que celui de la troisième. Dans le *fuscus,* ces deux bords ne diffèrent pas sensiblement en longueur. *Mâle* inconnu».

Female: 9-9.5 mm. — Black, antennae dusky reddish beneath, femora black, tibiae and tarsi dark reddish brown, segment I and II of abdomen ferruginous. Inner orbits at the sides of the antennal cavities with white-yellow spot. Prothorax anteriorly at the sides with transverse yellow-white spot. Fore margin of clypeus and mandibles ferruginous. Wings slightly infumated, with darker apical margin.

Head, in frontal aspect, transverse, dull, aciculated; eyes scarcely emarginated within, half of frons much broader than one eye. Clypeus touching eyes, short, fore margin reflexed, nearly straight. Temples, in lateral aspect, more than half as thick as the eye ; head, viewed from above, across temples nearly as broad as across eyes, i.e. they are not widened posteriorly. Ocellar distance much shorter than ocello-ocular distance. Antennal 3 as long as 1 + 2. Prothorax short, deeply angularly excavated behind, with shallow median sulcus (scutellum destroyed by the pin). Postnotum short, very narrow medianly. Propodeum very finely transversely striate, more conspicuously so at the sides. Abdomen slightly shining, *very finely and sparingly punctured.* Apical tergite on dorsum densely set with raised hairs. Cell r2 larger than r1 ; cell sc almost parallel-sided, R vertical at apex. Longitudinal veins of fore wing ending far from margin. Nervulus strongly postfurcal. Longer calcar of hind tibiae about half as long as metatarsus. Claws feebly dentate.

The characters of the male may be gleaned from Haupt's key (l.c., 1935).

Habitat: 1 female, Marg, v., leg. Chakour.

Cryptochilus discolor (F.)

1926. *Cryptochilus discolor* Haupt, Psammoch. Europas, p. 73.
1935. *Cryptochilus discolor* Haupt, Psammoch. Mediterr. II, pp. 286 and 298.
1935. *Cryptochilus discolor* Haupt, Pompilidae Palaestinas, MS.

Female: 17.5-19.5 mm. — Head, scutum, scutellum and mostly the hind margin of the postscutellum ferruginous, as well as the legs and antennae ; coxae and femora black, the latter broadly ferruginous at apex, tarsal joints dark at apex, last joint wholly dark. Sides and base of clypeus, mandibles and a spot including ocelli, black. Wings yellow, apical margin, and *in the hind wings also the posterior margin, dark.*

Head thick, temples, in dorsal aspect, well as broad or somewhat broader than head across eyes ; in lateral aspect, temples somewhat narrower than one eye. Orbits nearly parallel below, slightly emarginated above, frons above scarcely or little narrower than below. Clypeus in front slightly broadly emarginated, laterally touching eyes, strongly convex, mostly with two large punctures in the middle, not longitudinally striate. Cheeks short. The eye somewhat narrower than half of frons. Distance of hind ocelli shorter than ocello-ocular distance. Antennae with joint 3 well as long as 1 + 2. Distance of eyes on vertex greater than length of antennals 2 and 3 combined. Prothorax short, with two lateral calli, well developed sulcus and depressed hind margin. Notauli deeply incised. Scutellum flattened, truncate behind and, like the postscutellum with a few vertical black bristles. Postnotum not visible. Propodeum convex, somewhat sulcate and with fine, often indistinct carina, otherwise *irregularly sculptured,* rugose, without noticeable transverse striation just within the stigmata, only at middle with feeble, and posteriorly with some transverse, striae. Tergites of abdomen with sparse, fine and shallow punctures and with an easily rubbed off pruinosity. Abdomen at apex, as usual, with dense pilosity. Veins Rt1 and Rt2 strongly oblique, Rt1 little curved or almost straight, Rt2 straight, Rt3 curved ; 1st abscissa of R about half as long as 2nd, 3rd mostly somewhat longer, 4th subequal to 3rd.

Male: 15-16 mm. — The male is different from that of *C. niloticus,* with which it agrees in the coloration, in that the prothorax is shorter, slightly narrowed towards apex, *slightly transverse.* The clypeus is not flattened in front, but strongly convex, as a whole, has a trapezoidal outline, and is more feebly emarginated in front. The temples are, in dorsal view, shorter, the head is broader. The thorax is more than 2 mm. broad. Postnotum short, one-third of postscutellum, emarginated posteriorly. Propodeum long, distinctly longitudinally striate posteriorly. The hind wings are, in perfect specimens, broadly margined with brown, posteriorly. As in *C. niloticus,* all tibiae are ferruginous.

Habitat: This species occurs only in the Northern coastal area and is not rare. It was collected at Hammam, Ikingi, Borg El-Arab and Amriah, and is represented in all local collections.

Distribution: According to Haupt the species is distributed over nearly all the Mediterranean shores, occurs in Asia minor and from Armenia to Turkestan. I saw a specimen from Yemen (coll. Min. Agric.).

I compared my specimens with those of the collection of the Bavarian State in Munich, identified by Haupt.

Cryptochilus niloticus spec. nov.

Female: Very similar to the foregoing species, having the same coloration, except that the hind wings have no dark hind margin, only the apical margin is narrowly darkened ; in the fore wings the black marginal darkening does not reach the lower tip of cell r3, as it is the case in *discolor*. The propodeum is *everywhere,* also in front at middle, evenly and coarsely transversely striate. Head, in dorsal aspect, across eyes about as broad as across temples. Vein Rt2 strongly oblique, slightly S-shaped, but almost parallel to Rt1. I was unable to find any other differences.

Male: 11.5 mm. — Very slender, width of thorax less than 2 mm. Prothorax long, in dorsal aspect about square of outline, or only little longer than broad, almost parallel-sided, very little narrowed towards apex. Hind wings (in perfect specimens) scarcely noticeably or not shaded at hind margin, the darkening of the fore wing enters slightly the cell r3.

Head, dorsally parallel-sided, in frontal aspect with vertex somewhat raised, margin of vertex straight at middle, truncate. Temples somewhat rounded-angular. Clypeus elevated, flattened anteriorly, crescent-shaped in outline, the large bristle-bearing pores situated in front of middle. Postnotum about one-third as long as postscutellum, with shining foveola in the middle. Propodeum cylindrical, smooth, shining, at the hind angles with small foveola, behind of which there are a few short striae ; the transverse sulcus medianly near apex is scarcely noticeably transversely striate, at the sides obliquely so. Lateral margin only posteriorly very shortly reflexed.

Habitat: This species is rare in the North, occurring in Middle Egypt. I know one record (if it is not erroneous) from Amriah ; else the insect was taken at Borgash, Kafr Hakim, Abu Rowash and Kerdasa, Cairo, Giza, Maassara, Helwan, Dashour and Fayoum.

Cryptochilus mareoticus spec. nov.

Female: 14 mm. — In its coloration and otherwise fully agreeing with *C. discolor.* Differing only by the following characters : The head is, seen from above, distinctly narrower across the temples than across the eyes. The clypeus is finely longitudinally striate, particularly in front, dull and finely pilose anteriorly, without having (if always ?) the couple of large, setiferous punctures. The sculpture of the propodeum is about the same as in *discolor,* i.e. without regular transverse striae, as it is the case in *niloticus.*

Male: The male I am hesitatingly referring to this species (it was in one case collected on the same place as the female) has comparatively short prothorax.

Length 9-10 mm.. Width of thorax less than 2 mm. Body ferruginous in front, head across ocelli black from one eye to the other, vertex and frons ferruginous, femora black, apices broadly ferruginous. Wings as in the female, hind margin of hind wing more narrowly darkened.

Head, from above, across temples narrower than across eyes. Position of ocelli obtusely angular, (pol) scarcely shorter than (ool). Clypeus, in lateral aspect, strongly convex, *not flattened,* shining, indistinctly and broadly emarginated in front. Temples (laterally) more than half as thick as the eyes. Pronotum, in front, not quite vertical, somewhat declivous, margin not sharp-edged but somewhat blunt and angularly rounded ; pronotum twice as broad as long, very slightly narrowed towards apex. Scutellum convex. Propodeum dull, little sculptured in anterior third, but otherwise with *fine, oblique striae* that run from the interior parts obliquely to the sides, and become transverse striae before hind margin of propodeum ; hind angles without distinct foveae, but the lateral margin is posteriorly distinctly edged, the lateral fine sulcus reaching from posterior margin to about the middle of the sides.

Habitat: 1 female and male (iii. and xi. respectively) from the Mariout (? Amriah), leg. H. Priesner.

Cryptochilus schmiedeknechti spec. nov.

(Synonym : *Cryptochilus femoralis* Kohl (nec Spin.), in sched.).

Female: 11-16 mm. — Easily recognizeable by the coloration of the femora ; these are black in basal fourth or at most third, otherwise ferruginous. Antennae ferruginous. Head only below antennae narrowly and transversely black, fore margin pale. Head, prothorax, scutellum and postscutellum ferruginous, scutum strongly blackened, only in some specimens with small reddish median spot, otherwise black. Tarsi ferruginous. Wings yellow, fore wings blackened at the margins, the darkening reaching cells sc and r3; hind wing at hind margin scarcely, at apex more extensively and straight-limited, blackish.

Head, from above, somewhat narrower across cheeks than across eyes, temples appearing parallel-sided right behind eyes. Clypeus convex, faintly longitudinally striate, or rugose, fore margin sharply detached by a transverse sulcus. Vein r2 little oblique, slightly curved (in *discolor* nearly straight and strongly oblique). Propodeum rather evenly *transversely* striate (rugose), about as in *niloticus*.

Male: 7.5-11 mm. — Black, clypeus ferruginous anteriorly, orbits broadly so (interior ones more or less yellow), prothoracic calli and also somewhat the postscutellum, ferruginous. Legs as in the female, the tarsi somewhat brownish.

Prothorax *short,* only half as long as broad at fore margin, nearly parallel-sided in posterior half, strongly rounded and narrowed from middle to apex. Propodeum short, *evenly and finely transversely striate.* Clypeus convex, not flattened, with dense and fine brownish pubescence and with two long middle bristles as in the female.

Habitat: « Adeleninsel », leg. Schmiedeknecht. The locality, the local name of which is unknown to me, is probably a Nile island in Upper Egypt (⁵). I saw several specimens in the collection of the Nat. Museum Vienna. The species is not represented in any Egyptian collection. The series contains some specimens of the same species from Oran and Tunisia.

Distribution: Egypt, Algeria, Tunisia.

Cryptochilus detectus spec. nov.

Male: 11-11.5 mm. — Coloration as in *niloticus.* Head black only in the ocellar triangle. Prothorax, scutum, scutellum ferruginous, metanotum, propodeum and abdomen black. Legs ferruginous, coxae and femora (except their apical third) black. Hind wing also at hind margin somewhat shaded with grey.

Clypeus convex, not depressed (as in *niloticus*), but at base somewhat more strongly convex (as in *discolor*), though shorter than in *discolor,* more than twice as broad as long ; the pair of bristle-bearing punctures somewhat in front of middle ; clypeus in front distinctly broadly emarginated. Antennal 3 nearly as long as 1+2. Head posteriorly, in dorsal aspect, very little narrower than across eyes ; in frontal view the margin of the vertex is not as in *niloticus* straight, but rounded. The pronotum is in the middle about half as long as broad at fore margin. Scutellum flat. Propodeum long, as in *discolor,* but shining, posteriorly in the middle with some longitudinal striae that do not reach to middle towards base ; there is a very deep

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(⁵) cf. Honoré, *Bull. Soc. Roy. Ent. d'Egypte,* XXVI, p. 49 (1942); Morice, *Ent. Mag.,* p. 167 (1900).

fovea at the sides, but the lateral margin is reflexed (edged) only for a very short distance. Vein Rt2 oblique, nearly parallel to Rt1.

Habitat: I only know a unique specimen from Abu Rowash, 5.v.1935 (leg. H. Priesner).

Cryptochilus femoralis (Spinola)

1838. *Pompilus femoralis* Spinola, *Ann. Soc. Ent. France*, p. 458 (male and female).

Original description : ... « Female. Long 6 lig. Larg. 1 lig. 1/4. Antennes, tête en grande partie, dos du prothorax et du mésothorax, genoux, extrémité tarsienne des tibias, tarses en entier, testacéo-ferrugineux. Palpes, mandibules, joues, une tache sur le vertex, entourant les trois ocelles, dos du métathorax, flancs du corselet, poitrine, hanches, trochanters, base des fémurs, une tache au milieu des tibias, noirs. Ailes jaunes ; bord postérieur noir ; nervures testacées. Post-écusson aplati. Métathorax de la longueur du mésothorax, convexe, n'étant ni tronqué ni échancré, mais s'abaissant insensiblement d'avant en arrière. Dos du prothorax et du mésothorax glabres, luisants, imponctués. Dos du métathorax terne, ridé transversalement, pubescent. Poils cendrés. Flancs du corselet ridés longitudinalement. Abdomen plus long que le thorax ; derniers segments un peu velus. Poils bruns. Sa tête n'a pas de rides ou sillons. On voit seulement un petit enfoncement qui entoure la base de l'ocelle antérieur. »

« Mâle. Long. 5 lig. Larg. 2/3 lig. Coloré comme l'autre sexe. Genoux un peu plus largement ferrugineux. Corselet plus long que l'abdomen. Prothorax plus allongé que dans la femelle. Prosternum étant cependant deux fois plus large que long, et remontant obliquement en avant. Métathorax visiblement plus long que le mésothorax, glabre luisant comme les autres pièces thoraciques dorsales, *sans rides transversales,* plan près de la base, commençant à s'abaisser à peu de distance, et descendant ensuite très doucement d'avant en arrière ».

From the above description it appears that it is a small species about of the size of the following species, *C. minor* n. sp. It could not be, however, the same species, since Spinola says in his description that the femora are black at base only, and we know that the coloration of the legs is for the species of this genus rather constant. Other species are out of question, too, not only owing to their size, but especially because in *femoralis* the tibiae have a black spot exteriorly. As to my opinion, this species, if it is really Egyptian, and not Sudanese, has hitherto not been found again.

Cryptochilus minor spec. nov.

Female: Much smaller than *discolor* and allies, 8.7-12 mm. Coloration similar, but scutum and scutellum sometimes black. The ocelli have no black spot. Hind, and mostly also middle, femora always wholly black, tibiae mostly at apex narrowly blackened. The darkening of the yellow fore wing reaches cell r3 and enters a little cell sc; in the hind wings is also the hind margin, as in *discolor,* narrowly darkened.

Head across the temples a little narrower than across the eyes, in dorsal aspect. Clypeus slightly convex, sides narrowed anteriorly, fore margin broadly truncate, surface without striation, but with a few punctures in a transverse row. Distance of hind ocelli much shorter than that between ocelli and eyes. Prothorax a little less convex, calli lower. Scutellum convex. Postnotum extremely short, scarcely visible. Propodeum everywhere (as in *niloticus* and *schmiedeknechti*) coarsely transversely striate. Wing venation similar to that of *discolor,* cells r2 and r3 are subequal above.

Male: The unique male, collected together with the above described female, is 7-8 mm. long, and differs from all males described herein by the wholly *black femora,* and the only basally pale hind tibiae, the dark extreme tips of the middle tibiae, and the mostly wholly dark middle tarsi whereby at most the metatarsus of the latter may be reddish. Prothorax strongly transverse, about twice as broad as long, *dull.* Clypeus normal, slightly convex, with a pair of bristle-bearing punctures.

Postnotum half as long as postscutellum, slightly emarginated behind. Propodeum shortly rectangular in outline, *transversely striate,* or only laterally so, in small specimens not distinctly striate, but quite dull.

Habitat: Males and females, Amriah, 13.vi., leg. Rabinovitch (coll. Alfieri).

Genus PRIOCNEMIS Schiôdte, Sustera

(cf. Haupt, Psamm. Europas, 1926, pp. 27 and 28; Arnold, Psamm. Ethiop. Reg., 1932, pt. I, p. 379).

Hind tibiae as in *Cryptochilus.* Nervulus postfurcal. *Cell sc pointed* at apex. Antennae slender. Claws dentate. Postnotum well developed. Stigmal tubercles on propodeum not conspicuous. Last joint of hind tarsi not spinose beneath. Parallel vein (Cu) of fore wing reaching apical margin.

Priocnemis (Priocnemissus) obliquus Haupt

(cf. Haupt, Pompilidae Palaestinas, MS.)

Female: 9-10 mm. — Body, antennae and legs wholly black. Head all around, prothorax, prosternum and fore coxae with raised black pilosity. Wings strongly infumated also at base, with darker longitudinal blotch in cells r and m, hind wings somewhat paler. Fore wings without pale apical spot.

Anterior body dull, abdomen slightly shining. Eye narrower than half of frons, scarcely emarginated within, frons above distinctly narrower than below. Frons and vertex and base of clypeus dull, aciculated, the latter distally with punctures of unequal size, apical margin shining, narrowly smooth; *clypeus at sides obtusely angled,* somewhat elevated dorsally and transversely convex. Cheeks extremely short. Temples, in lateral aspect, thick, about 3/4 of the eye, in dorsal aspect narrowed towards collar. Ocelli forming an acute angle, (pol) much shorter than (ool). Prothorax little convex, but in dorsal aspect slightly convex laterally, deeply emarginated behind, dorsum, like the scutum and scutellum, dull-aciculated. Scutellum flat, postnotum well half as long as postscutellum. Propodeum parallel-sided in front, narrowed towards apex, strongly convex in lateral aspect, declivity about as long as the horizontal portion, dull, coarsely aciculated, declivity finely transversely striate; propodeum at the sides posteriorly with few raised hairs. Abdomen distinctly aciculated, terminal tergite and the three terminal sternites strongly pilose. Legs slender, calcaria of hind tibiae about half as long as the metatarsus. Claws feebly dentate. Cutl of fore wing (nervulus) oblique, strongly postfurcal. Vein Rt1 little, Rt2 and Rt3 strongly curved, Rt2 below strongly directed inward; r3 below longer than r2; 2nd and 4th abscissa of R subequal, 1st half of 2nd, 3rd shorter than 2nd. Basal vein curved in upper and lower part. Vein Cut of hind wing strongly prefurcal, curved at apex, but not vertical.

Habitat: 1 female, Dekhela (Mariout), ii., leg. Storey (coll. Min. Agric.).

III. Subfamily MACROMERINAE Haupt

Genus PSEUDAGENIA Kohl

(cf. Arnold, Psamm. Ethiop. Reg., pt. III, p. 283, 290; 1934).

A distinct beard of some stiff and long bristles is present on the mentum. Clypeus strongly convex, often with a small tooth-like projection at the anterior margin. Antennae inserted somewhat distant from the clypeus Thorax dull, with distinct alutaceous sculpture, i.e. chagreened. Propodeum dull, mostly with transverse striation, without erect hairs near the hind angles. Thorax convex. Antennae and legs very slender.

Key to the species

Females

1 (4) Cell r2 subequal to r3 or slightly longer than it below.

2 (3) Fore margin of clypeus slightly and roundly produced in the middle. Fore wings with two distinct transverse bands and pale darkening

of apex. Median sulcus of postnotum elongate, complete. .... **bizonata (Walk.)**

3 (2) Fore margin of clypeus in the middle with bluntly dentate production. Impression of postnotum square or somewhat broader than long. Fore wing with only slightly shaded basal vein and indistinct 2nd transverse band, with light apical darkening. .... **arnoldi spec. nov.**

4 (1) Cell r2 shorter than r3. Bands of wing narrow, but distinctly marked. .... **nubica spec. nov.**

Males

1 (2) The 1st transverse band, along basal vein, conspicuous. Postnotum with narrow smooth median sulcus. .... **bizonata (Walk.)**

2 (1) The 1st fascia wanting, the other shadings faint, the faint 2nd band, moreover, shortened below. Postnotum with transverse, shining foveola. .... **arnoldi spec. nov.**

Pseudagenia bizonata (Walker)

1871. *Agenia bizonata* Walker, List of Hymenopt. colledted by Lord in Egypt, p. 16.

Original description: « Female.—Black, dull. Mandibles red. Antennae stout, curved. Metathorax extremely finely punctured, not keeled. Petiole short. Wings cinereous, veins and stigma black. Fore wings with two blackish bands, the first in the middle, the second nearer the tip. Length of the body 4 lines. ... Cairo. »

Female: 7.5-8.5 mm. — Black, finely silvery grey pubescent, on the coxae and posteriorly at the sides of the propodeum more densely and less evenly so. Apical tergite with brownish margin, pointed, finely and pale pilose, whitish transparent at the margin. Antennae dark reddish to black. Fore wings with two transverse bands, the 1st across the basal vein+Cut1, the 2nd across cells sc and r, the latter not reaching hind margin of wing; apical margin slightly shaded. The hyaline interval between apical darkening and 2nd band not sharply limited behind, while this is the case in other species.

Head and thorax *wholly dull,* finely granulate-aciculated, abdomen slightly shining, tergite VI strongly shining with sparse, coarse, shallow punctures. Eyes strongly emarginated for all their length, interiorly; frons above about as broad as below. Clypeus, in lateral aspect, strongly convex, touching the eyes, fore margin from here first converging, with narrowly raised apical margin, then bluntly angular and more strongly converging, the median fifth of the fore margin somewhat roundly produced.

with somewhat broader, shining but not elevated edge. Only mentum with beard, cardines of maxillae without beard. Cheeks extremely short. Upper distance of eyes equals about length of antennal joints 2 and 3 combined. Temples, in lateral view, not half as thick as the eye. Ocelli forming a slightly acute angle, (pol) : (ool) = 2:3. Antennal joint 3 about as long as 1 and 2 combined. Pronotum broadest, and strongest convex, near base, from here narrowed towards apex. Postnotum as long as postscutellum, transversely striate, with deep median sulcus, not incised at middle of hind margin, slightly produced. Propodeum only slightly convex lengthwise, the horizontal part about as long as the little declivous posterior part; surface with extremely fine transverse wrinkles. Abdomen shortly petiolate. At least Cu of fore wing and R of hind wing reach the margin; cells r2 and r3 little differing in length below; all three veins Rt slightly curved. Basalis below strongly curved, nervulus (Cut 1) nearly interstitial (very slightly postfurcal). 1st abscissa of R one-third to one-half of 2nd, the latter one and one-half of 3rd, 4th as long as or somewhat longer than 3rd. Vein Cut of hind wing joining Cu in a pointed angle, prefurcal. Spines on under side of terminal tarsal joints sparse and very fine, basad.

Male : 6.5-7.5 mm. — Body and wings coloured as in the female. Frons below distinctly white pubescent. Antennal 3 about four times as long as thick, about as long as 1 and 2 combined, the latter elongate, joint 1 distinctly curved. Fore margin of clypeus somewhat less produced at middle. Frons below slightly narrower than above. Pronotum laterally only slightly rounded, narrowed towards apex. Propodeum only very slightly convex lengthwise, transverse striae quite indistinct. Postnotum with narrow, smooth median sulcus, that continues in some specimens onto the propodeum. Abdominal segment I thin at base, somewhat more than twice as long as broad, tergite VII truncate, transverse, dark. Anal sternite forming a broad, truncate plate that is finely and shortly pilose at the margin, and bears about 4 pairs of longer setae. Cut 1 of fore wing interstitial.

Habitat : The insect was collected in Cairo, at Gebel Asfar, Meadi, Helouan and Fayoum, and also at Fayed in the Canal Zone (iv-x).

Pseudagenia arnoldi spec. nov.

Female : 5-7 mm. — Surface dull, black, as in *bizonata,* also the silvery pubescence is equally distributed, the frons is distinctly whitish pilose, below. Clypeus greyish white. Fore margin of the strongly convex clypeus is at the sides formed as in *bizonata,* but is in front not broadly produced, having a narrow, shining rounded tooth-like projection in the middle. Orbits interiorly nearly parallel below, the emargination noticeable only somewhat above middle. Distance of hind ocelli almost only half as long as that between ocelli and eyes. Temples, in lateral aspect, scarcely half as thick as one eye. Antennal joint 3 almost longer than 1st and 2nd combined. Beard on mentum as in the former species. Prothorax at the sides somewhat less convex. Postnotum hardly as long as the postscutellum, shining, coarsely transversely striate, impressed in the middle, without narrow sharp sulcus, i.e. with fovea. Propodeum without basal sulcus, finely transversely rugose. The horizontal part of the propodeum as long or little shorter than the flat declivity. Tergite VI shining. *Wings without the 1st band,* only basal vein and nervulus (Cut 1) slightly shaded, and band and apical darkening *faint,* very pale grey. 2nd abscissa on R twice as long as 1st, one and one-half times as long as 3rd, 2nd and 4th subequal in length. Basal vein and 2nd recurrent vein (Mt3) somewhat less strongly curved, than in *bizonata.* Legs and antennae (inclusive of coxae) sometimes black-brown. In small specimens the transverse rugosity of the propodeum is finer and appears, by very fine interposited longitudinal wrinkles, very slightly reticulated. Under side of hind tarsi without rows of small spines.

Male: 5.5 mm. — Coloration as in the male of *bizonata,* the legs often wholly dark reddish brown, apices of fore tibiae exteriorly, and fore tarsi greyish testaceous. Wings without distinct transverse bands, only with faint apical darkening, reaching across cells. Tergite VI red-whitish at apical margin, transparent. Excavation of eyes not extended over the whole eye but noticeable only above middle. Postnotum with roundish or almost square fovea. Propodeum at base without rudiment of sulcus. Anal sternite half-elliptical, narrow, without longer bristles, only with short marginal ones. Basal vein of fore wing only slightly curved. Nervulus (Cut 1) interstitial. Tergite I of abdomen more slender, more than 2.5 times as long as broad.

Habitat: Males and females, Esbeth-el-Nakhl, Maassara, Helwan, Kerdasa and Ginefa (vi.-ix., xi.). Less common than *P. bizonata.*

Pseudagenia nubica spec .nov.

Female: 6-7 mm. — Black, antennae at base beneath slightly dull red, interior and exterior orbits ferruginous like fore margin of clypeus and mandibles. Wings hyaline, with two strong but very narrow black transverse bands, the 1st of which acompanying (as a narrow line, of either side) the basal vein and the nervulus (Cut 1), the 2nd filling the interior angle of cell sc and the whole cell r2 and forming a spot in the upper half of cell m3.

Eyes distinctly emarginated within, orbits below slightly converging towards clypeus, in their upper part distinclty converging towards vertex. One-half of frons broader than the eye. Ocelli forming a pointed angle, (pol) shorter than (ool). Clypeus and mandibles touching eyes. Fore margin of clypeus first converging, this basal portion somewhat depressed, then fusing obtusely angled into the broadly rounded, though distinctly somewhat produced, fore margin proper; the fore margin rounded at middle, not pointed (as in *arnoldi*) or lobiform (as in *bizonata*). Beard of mentum consisting of few bristles. Temples, in lateral view, short, hardly half as thick as the eye. The whole body dull dorsally, the abdomen only slightly shining. Antennal joint 3 as long as or little longer than 1+2. Distance of eyes on vertex well as long as antennal joints 2 and 3 combined. The hind margin of the anteriorly steeply declivous prothorax appears somewhat depressed. Postnotum long, in the middle as long as the postscutellum, shining, strongly transversely striate, with broad median sulcus that is also striate. Propodeum flatly convex, in front little distinctly (irregularly rugose) sculptured, behind somewhat transversely rugose. Abdomen greyish pruinose. Nervulus Cut 1) interstitial or slightly postfurcal. Cell r3 at least below distinctly longer than r2. Vein Mt3 joining M in the first fourth or third of cell r3. Under side of hind tarsi without rows of small spines. Claws distinctly dentate.

Habitat: Gebel Elba (Wadi Aideb), i. (leg. H. Priesner).

On comparing with the Ethiopian species described by Arnold one comes in the key to *pumilio* Arn. In our species, however, the fore margin of the clypeus is not straight and truncate, it is dark at base, and the inner orbits are not parallel; the wing design is in *nubica* more sharply defined, rather similar to that of *P. rubrirostris* Arn. (cf. Arnold, l.c. pt. III, pl. I, fig. 13).

Genus POECILAGENIA Haupt

1926. *Poecilagenia* Haupt, Mon. Psamm. Europas, p. 130.

Beard absent, mentum glabrous. Clypeus little convex, rounded in front. Antennae inserted more closely to clypeus than in *Pseudagenia*. Thorax with distinct, though shallow, puncturation. Propodeum reticulate-rugose. Postnotum, at least at the sides, with oblique or more vertical striation. Thorax less convex than in *Pseudagenia*. Propodeum near posterior angles with whitish pilosity.

Poecilagenia rufipes spec. nov.

I only know two female specimens of this species, the largest of which is about 8 mm., the smaller one about 5 mm. long. I am giving first the description of the small, perfect specimen.

Female: 4.6 mm. — Black, rather smooth, abdomen shining. Legs (inclusive of coxae) *pale ferruginous*, hind tibiae and middle and hind tarsi darkened. Wings hyaline, without bands, veins testaceous, costa and pterostigma dark.

Head (in anterior aspect) almost circular, though somewhat broader than long. Frons finely and densely *punctured,* below scarcely broader than above. Eye distinctly narrower than half of frons. Clypeus very strongly transverse, slightly convex, truncate in front; sulcus between frons and clypeus deep, with a foveola on either side. Labrum situated vertically below clypeus, forming a narrow band. Clypeus broadly touching eyes, cheeks extremely short, linear. Ocelli forming a pointed angle, (pol) much smaller than (ool). Temples, in lateral view, evenly wide, about half as thick as the eye. Antennal joint 2 elongate, 3 about twice as long as 2, about as long as joint 1. Prothorax, in dorsal aspect, with slightly convex sides; viewed laterally very little convex; hind margin roundly emarginated, like the mesonotum with very fine rugose puncturation, with some sparse shallow punctures in between. Thorax, from the sides, little convex, scutellum not higher than the postscutellum, postnotum only half as long as the postscutellum, *laterally with some obliquely posited wrinkles,* and with fine median sulcus. Propodeum about as long as broad, with fine median sulcus: sculpture irregulary rugose; posteriorly with adpressed, and besides, laterally with raised white hairs. Abdomen very shortly petiolate, shining, even at higher magnifications (about 20 times) without noticeable sculpture; the margins of the segments are reddish transparent, apical segment smooth, shining. 1st radial transverse vein (Rt1) straight, Rt2 and Rt3 slightly bent, cells r2 and r3 subequal. Vein Cut 1 postfurcal. Vein Cut of hind wing strongly prefurcal. Longer calcar of hind tibiae half as long as metatarsus. Under side of tarsi without rows of spines. Claws distinctly dentate.

Habitat: Helwan, xi., leg. H. Priesner.

The large specimen (head missing) has also pale ferruginous legs, with fore coxae and tarsi dark. Wings exactly as in the former specimen. Thorax dull, pronotum, dorsulum and scutellum densely and finely punctured and in between with sparse, shallow, coarse punctures. Postnotum shorter than postscutellum, with shining foveola in the middle, laterally with oblique (nearly vertical) coarse wrinkles. Pilosity of propodeum the same as in the former; sculpture coarsely and unevenly rugose, the rugae form in the middle a fine longitudinal carina. Abdomen shining, pruinosely pubescent, very finely sculptured (visible at 35-times magnification). Tip of abdomen sparingly and erect pale pilose. Terminal calcar of hind tibiae scarcely half as long as the metatarsus. Cell r2 higher than rl, and higher than sc. Claws distinctly dentate. Since the sculpture of the propodeum may vary with the size within the same species in different *Pompilidae*, I consider the two specimens to belong to the same species.

Locality: Shoubra (Cairo), x., leg. Adair (coll. Min. Agric.).

Male: 6 mm. — A unique male that doubtless belongs to this species agrees almost in its coloration with the above females, except that the coxae are somewhat darkened and the fore femora at base so, tarsi dark, in the middle legs the tarsi are dark, and in the hind legs only the femora pale ferruginous, while the tibiae and tarsi are dark. Wings as in the female. *The anterior body is clothed with a short, raised, white pilosity.* Temples and prosternum with longer whitish pilosity. Frons densely punctured, with sparse, larger punctures, *vertex almost smooth, shining.* Body also otherwise somewhat shining, but not so distinctly as the vertex. Head behind ocelli considerably raised. Eyes as broad as half of frons. Clypeus in front broadly truncate. Temples, in lateral aspect, widened above, in the middle about half as thick as the eye. Antennal joint 2 still longish, 3 shorter than 1, 4 and 5 each about as long as 1. Prothorax little narrowed towards apex. Scutellum convex, higher than the postscutellum. Postnotum in the middle long, little shorter than the postscutellum, with elongate foveola from which radiate coarse, arched wrinkles, so that the postnotum appears only at base narrowly transversely striate, else it is obliquely striate. Propodeum not very coarsely unevenly rugose, shining, with adpressed and raised whitish pilosity at the sides posteriorly, and with scarcely visible median sulcus. Tergite I of abdomen about twice as long as broad, conical. Sculpture of the abdomen as in the female; tergite VII broadly margined with ivory white, anal sternite very slender, triangular, pointed. Longer calcar of hind tibiae about as long as two-thirds of the metatarsus. Claws finely dentate.

Locality: Maassara, ix., leg. H. Priesner.

IV. Subfamily CTENOCERINAE Arnold

1929. *Claveliinae* Haupt, *Mitt. Zool. Mus. Berlin,* XV, p. 111.
1932. *Claveliinae* Arnold, Psamm. Ethiop. Reg., pt. II, p. 41.
1934. *Ctenocerinae* Arnold, l.c., pt. III, p. 386.

In this subfamily only such forms should be included that agree with the following characters :

(1) Antennal flagellum biramous or serrate.

(2) Absence of preapical spines on the middle and hind femora.

(3) Short and straight backwardly directed apical spines on the tibiae.

(4) Not pointed cell m3 at basal proximal angle, and

(5) Little curved or nearly straight terminal part of Cu of hind wing.

However, according to Haupt's new system (Beitr. z. taxonom. Zool., I, 1949, pp. 65-75) and his « Pompilidae Palästinas » (MS.) some other forms, described in this paper under *Pompilus* (s. lat.) would have to come to this subfamily, i.e. the subgenus *Pareiocurgus* Haupt, the subgenus *Nanoclavelia*

Haupt, both also Egyptian, as well as the genus *Poecilagenia* (see above) and the non-Egyptian genus *Calicurgus* Lep.

In Egypt, no true representatives of the Subfamily *Ctenocerinae* have been found up to the present.

V. Subfamily POMPILINAE Ashm.

This largest group has been divided into tribes by Arnold (l.c., pt. VII, pp. 75-80, 1937), as follows: *Cordyloscelini, Teinotrachelini, Psammoderini, Pseudopompilini, Platyderini, Tachypompilini, Spuridiophorini, Homonotini, Idopompilini* and *Psammocharini* = *Pompilini*. Of these the tribe *Homonotini* and *Idopompilini* I have excluded, and the former in agreement with Haupt considered a subfamily, the latter included in Haupt's subfamily *Epipompilinae*. In addition to the above, I regarded as tribe Haupt's subfamily *Pedinaspinae*, although Arnold did not treat it alike, possibly only owing to the fact that they are not Ethiopian, and do thus not form part of his Monograph.

For Egypt we have, therefore, to deal with the following tribes:

I. *Pedinaspini* nov. — Similar to *Pompilini*, but eyes narrower, clypeus mostly concave at the sides, often forming a rectangular plate, in the female. Scape usually somewhat flattened. Body dorsally set with raised hairs. Thorax slightly flattened dorsally, fore legs sometimes incrassate. Males difficult to distinguish from those of the *Pompilini*. By the shape of the clypeus the *Pedinaspini* are convergent with most of the *Ctenocerinae*, but are always distinguished from them by the splayed out spines of the hind tibiae and the pointed cell m3 of the fore wing, *Pedinaspis*, moreover, differing in the shape of the end of the Cu of the hind wings.

Genera: *Pedinaspis* Kohl, *Aporus* Spin.

II. *Pompilini* nov. (*Psammocharini* Arn.). — Propodeum normal (as in the former tribe), at least the declivity not sharply margined. Vertex rarely sharply margined. Eyes and clypeus normal. Apical abdominal segments of female not compressed. Body dorsally not flattened, fore femora not incrassate, antennal joint 1 not compressed.

Genera: *Pompilus* F. (sens. lat.), *Leuchimon* Haupt, *Dicyrtomellus* Guss., *Anoplius* Duf., *Anospilus* Haupt, *Pompiloides* Rad., *Paracyphononyx* Grib., *Batozonellus* Arn., *Episyron* Schdte., *Protelostegus* nov., *Telostegus* Costa, *Schistonyx* Sauss., *Evagetes* Lep. (sens. lat.), *Micropompilus* nov. and *Chionopompilus* nov.

III. *Psammoderini* Arn. — Clypeus convex transversely and longitudinally, more than twice as wide as long. Mandibles with one preapical tooth. Sternite II without a curved transverse furrow. Propodeum not enfolding tergite I of abdomen.

Genus: *Paraferreola* Sust.

IV. *Platyderini* Arn. — Clypeus flat, more or less discoidal, less than twice as wide as long. Mandibles with two teeth behind apex. Sternite II of abdomen with a curved, transverse and usually punctured impressed line. Propodeum not enfolding tergite I.

Genus: *Platyderes* Guér.

V. *Pseudopompilini* Arn. — Propodeum with its truncate part enfolding base of abdomen, sides of the declivity lamelliform, appearing from above as teeth. Antennae close to clypeus, short. Ocelli situated in a flat arc. Claws very short, bifid. Apical spines of tibiae not splayed out, short.

Genus: *Pseudopompilus* A. Costa.

I. Tribe Pedinaspini m.

Genus PEDINASPIS Kohl

1937. *Pedinaspis* Haupt, *Boll. Ist. Ent. Bologna,* IX, pp. 73-86 (Key).

Pronotum less convex dorsally than in *Pompilus,* anterior face steep, sides with longitudinal convexity. Clypeus more or less concave at the sides, right beyond base, sometimes forming a rectangular smooth and shining plate. 1st antennal joint rather short, somewhat curved. Eyes always narrower than half of frons. Scutellum flattened, rather sharply margined laterally. Last sternite of abdomen always slightly keeled. Fore tarsi short, without distinct comb, joint 4 as long as broad. Vein Mt2 ending near Rt2. Three radial cells present. Claws dentate. Male having head and thorax pilose, dorsum of thorax strongly convex; concavity of clypeus always much less pronounced than in the female; vertex behind ocelli slightly raised; all antennal joints shorter than the 1st.

Key to Egyptian species

1 (4) In frontal aspect the ocelli are situated distinctly below a line across dorsal margins of eyes. Cell r3 above much shorter than r2.

2 (3) Body wholly black. Propodeum in the middle of its posterior half distinctly transversely striate. .... **salvatoris Kohl**

3 (2) Black, tergites I and II more or less red. Propodeum without conspicuous sculpture. .... **bucephalus Tourn.**

4 (1) In frontal aspect the paired ocelli lie on the above named tangent. Cell r3 subequal to r2, or 2nd and 3rd abscissa of R subequal. Black, tergite II dull red near base. .... **plagiatus Haupt**

Pedinaspis salvatoris Kohl

1937. *Pedinaspis salvatoris* Haupt, *Boll. Ist. Ent. Univ. Bologna,* IX, p. 76, fig. III.

Female: 11-19 mm. — Wholly black. Body covered with fine pruinose pubescence. Fore wings strongly infumated, with darker apical margin, hind wings a little paler.

Head heavy, much broader than the thorax. Eye narrower than half of frons, orbits slightly curved, frons below slightly broader than above, with short longitudinal sulcus above antennal cavities. Ocelli far from margin of vertex, forming an obtuse angle, (pol) smaller than (ool). Clypeus transversely rectangular, sides straight, much rounded at angles, and feebly emarginated in front, surface smooth, shining, without larger punctures. Temples, in lateral aspect, about as broad as eye, in dorsal aspect thick, but the head is narrower across the temples than across the eyes. Antennae slender, joint 1 slightly curved, joint 3 thin, about five times as long as 2. Prothorax strongly convex, steep in front, broadly and deeply emarginated behind. Postnotum about half as long as postscutellum, shining, transversely striate, with transverse central fovea. Propodeum short, declivity about as long as basal part, transversely striate except medianly in front where the striation is oblique so that there appears a triangle formed of fine rugae. Vein Cut1 somewhat post-furcal. Cell r2 and r3 subequal below, but 2nd abscissa of R longer than 3rd, vein Rt1 and Rt3 curved, Rt2 nearly straight. Longitudinal veins of fore wing ending far from apical margin. Vein Cut of hind wing joining Cu not quite vertically, somewhat prefurcal. Fore tarsi on metatarsus with 3 extremely short comb spines which are not longer than the apical width of the metatarsus, one lower comb spine subequal. Longer spur of hind tibiae not quite half as long as the metatarsus. Claws distinctly dentate.

Male: According to Haupt (l.c.) agreeing with the female in colour, wing venation and sculpture of the propodeum, though the latter is somewhat finer, and usually covered by the pubescence.

Habitat: 2 females, Sinai, Wadi Gederât, v., leg. Rabinovitch (coll. Alfieri).

Distribution: Egypt, Palestine.

Pedinaspis bucephalus Tournier

1937. *Pedinaspis bucephalus* Haupt, *Boll. Ist. Ent. Univ. Bologna,* IX, p. 77.

Female: 12-15 mm. — Belonging to the group of *salvatoris* in having distinctly parallel-sided clypeus and broad frons, and having the ocelli situated on a rather low level. — Black, 1st and 2nd tergite red, 2nd with black hind margin that is somewhat widened in the middle. A shortly built, stout species. The propodeum is not sculptured, has a flat and hardly visible longitudinal sulcus, and feebly developed stigmal sulci. The tarsi of the fore legs are reddened and more or less densely white pubescent. Pronotum in the middle half as long as broad anteriorly, and at fore margin distinctly impressed in the middle. Cell r3 is not fully closed.

Distribution: Egypt, Morocco, South Spain. I have not seen this species, since it is not represented in any of the Egyptian collections.

Pedinaspis plagiatus Haupt

1937. *Pedinaspis plagiatus* Haupt, *Boll. Ist. Ent. Univ. Bologna,* IX, p. 80, figs. VII and VIII.

Female: 10-15 mm. — Black, tergite I and sometimes also II dull red. Body anteriorly, and more or less tergite I with raised black pilosity. Legs and antennae black. Abdomen with extremely fine pruinosity producing a grey-blue sheen. Fore wings strongly infumated, without distinctly darker apical margin, hind wings somewhat paler.

Head broad, broader than thorax. Eyes, in frontal aspect, narrow, frons about four times as broad as the eye. Orbits below scarcely, above distinctly, convergent. Sulcus of frons short. Vertex behind ocelli somewhat raised. Position of ocelli almost rectangular, (pol) little more than one-half of (ool). Clypeus much narrower than frons below, *rectangular, smooth and shining,* parallel-sided, distinctly punctured anteriorly, fore margin slightly emarginated. Temples, in lateral aspect, in the middle nearly as broad as the eye, but much narrowed towards mandibles. Antennal joint 3 as long as 1+2. Head on the lower face with long black raised hairs, laterally. Prothorax, in dorsal aspect, somewhat convex at the sides posteriorly, then strongly narrowed towards apex, hind margin angular at middle. Scutellum flat, postscutellum convex, its posterior face vertical. Postnotum well half as postscutellum, transversely striate, with median sulcus. Propodeum short, declivity longer than horizontal portion. Tergite I almost vertical in front. All three veins Rt slightly curved, Rt3 sometimes with appendage exteriorly in the middle. 2nd and 3rd abscissa of R subequal, cell r3 below longer than r2. Vein Cut1 interstitial. Vein Cut of hind wing joining Cu in a somewhat acute angle, a little prefurcal. Fore tarsi short, joint 4 transverse, anterior metatarsus with 3 very short comb spines that are scarcely longer than the apical width of the metatarsus. Under side of 5th tarsal joint without spines. Claws dentate, pulvillus slender, with few comb setae which surpass it.

Male: According to Haupt 12-13 mm. long, and having only tergite II reddish. Genital plate narrowed towards apex, flatly excavated at hind margin, the latter densely pilose, lower face slightly convex in the middle, and set with long hairs.

Habitat: The species was found at Borg El-Arab (iii) by H.C. Efflatoun and M. Tewfik (coll. Cairo University), at Abuseer (near Borg), (iii), by A. Mochi, and at Abu Mena by T. Sayed.

Distribution: Egypt, Tripolitania to Morocco.

Genus APORUS Spinola

1927. *Aporus* Haupt, Mon. Psamm. Europas, p. 264.
1930. *Aporus* Haupt, *Mitt. Zool. Mus. Berlin,* XVI, pp. 730-751, figs.

Two radial cells. Vein Cut1 of fore wing postfurcal. R of hind wing not broken, vein Cut prefurcal and little curved, joining Cu in a pointed angle; apex of Cu straight and only little curved at extreme apex. Head flattened, resting cap-like on the prothorax, occiput excavated but not margined. Mandibles tridentate. Eyes slender. 1st antennal joint flattened, antennae inserted close to clypeus. Prothorax long, parallel-sided. Fore tarsi of female short, fore femora enlarged. Hind legs of male comparatively long, especially the coxae. Claws dentate. Small species.

Aporus (Aporus) hirtipennis (Saunders)

1901. *Pompilus (Planiceps) hirtipennis* Saunders, *Trans. Ent. Soc. London,* p. 541 (female).
1930. *Aporus hirtipennis* Haupt, *Mitt. Zool. Mus. Berlin,* XVI, pp. 741, 749; fig. 48.

Female: 7.5-8 mm. — Black, somewhat shining, with very fine grey pruinose pubescence; segments I-III of the abdomen indistinctly reddened dorsally. Wings shaded, more strongly so towards apex, hind wings much paler.

Clypeus very strongly transverse, transversely depressed at base, genae long. Frons about four times as broad as the eye. Ocelli forming an obtuse angle, (pol) much greater than (ool). Antennal joint 3 almost 1.5 times as long as 2, joint 4 longer than 3. Prothorax long, parallel-sided. Scutellum and postscutellum flat, postnotum not visible. Propodeum shorter than prothorax, with fine median line. Abdominal tergites slightly excavated at hind margin medianly, apex of abdomen with a few fine black bristles. Fore legs incrassate, without spines, fore tarsi short, metatarsus well as long as the three following joints combined, these broader than long. Pulvillus large, truncate at apex, the small basal plate with about 6 comb bristles. Claws dentate. Hind tibiae with few short spines, the longer calcar about half as long as the metatarsus. Basal vein of fore wing curved, Cut1 *strongly postfurcal,* Cu of fore wing not quite reaching apical margin; the two veins Rr slightly curved, 1st and 2nd abscissa of R short, subequal in length, each one 1/3 of the 3rd abscissa; 2nd recurrent vein (Mt2) interstitial, forming one line with Rt2 which is not so strongly curved as in *A. inermis* Brull. (cf. Haupt, l.c., p. 743, fig. 50). Cu of hind wing reaching apical margin; Cut joining Cu in a pointed angle, the analis in an obtuse angle, strongly prefurcal.

Habitat: Ikingi (Mariout), 20. iii. 1935 (leg. et coll. Alfieri).

According to Haupt this species differs from others, hitherto not found in Egypt, by the eyes that distinctly surpass the vertex, the pronotum which is shorter than broad in the middle, and by the shortly trapezoidal cell r2, and comes nearest to *A. inermis* Brullé.

II. Tribe Pompilini Haupt
(Psammocharini Haupt, Arnold)

Genus CTENAGENIA Sauss.

Like *Pompilus,* but sternite II of abdomen with transverse depression, femora without preapical spines in both sexes. Hind tibiae feebly spinose. Antennae of female only slightly convoluted. Legs and antennae very long. Abdomen with broad yellow transverse bands. Cu of fore wing reaches nearly the margin. Cell m3 only slightly produced below at base. Fore claws of male asymmetrical. — This genus is not much more than a subgenus of *Pompilus.*

Ctenagenia vespiformis (Klug)

(Fig. 2)

1812. Unnamed, Savigny, Descr. d'Egypte, pl. 17, fig. 16.
1834. *Pompilus vespiformis* Klug, Symb. phys., pl. 38, fig. 3, female.
1926. *Ctenagenia vespiformis* Haupt, Psammoch. Europas, p. 129.

Female: 15-30 mm. — Body with legs and antennae black, tergites II to V of abdomen *pale yellow,* narrowly margined with black, these dark margins somewhat produced in the middle. Anterior body strongly black pilose. Wings pale yellow, with dark extreme base, black margin, the hind wing scarcely or more narrowly margined than in the male.

Head, in dorsal aspect, strongly narrowed behind eyes, temples flatly rounded, frons with distinct median sulcus. Ocelli forming a pointed angle, (pol): (ool) mostly = 3:4. Eyes within distinctly broadly emarginated, little narrower than half of frons. Antennae long and slender, joint 3 twice as long as 1+2. Pronotum convex, with conspicuous calli, median sulcus and depressed hind margin. Scutellum flat above, postscutellum convex. Postnotum very narrow, finely transversely striate. Propodeum strongly convex, with median sulcus, and steep declivity where it is obliquely and strongly rugose, coarsely punctured, with long, erect pilosity. Tergite I steep in front, base slender, sternite II with shallow transverse depression. Cells r2 and r3 longer than high, r3 below somewhat longer than r2. Cu of fore wing nearly reaching apical margin; cell m3 at the inner basal angle little produced; Cut1 slightly postfurcal. Transverse anal vein (Cut) of hind wing interstitial, curved hook-like at apex. Metatarsus of fore legs as long as joints 2-4 combined, with 4 (and sometimes a very short basal one) lateral comb spines, and 3 *very* short spines of the under side; the last lateral comb spine is about as long as the 2nd tarsal joint. The longer calcar of the hind tibiae is only one-third as long as the metatarsus. Terminal tarsal joint with conspicuous rows of spines on under side (in both sexes). Claws slender, dentate, tooth situated near base, pulvillus small, comb bristles short.

Male: 9-22 mm. — Coloration as in the female. Hind wings at hind margin more broadly blackened. Interior claw of fore tarsi strongly curved, exteriorly before apex even slightly concave, with stout basal tooth.

Habitat: In Egypt a very common species, in the cultivated parts as well as in the desert; also on the northern and eastern shores (Mariout, Red Sea Coast).

Distribution: South East Europe, Asia minor, Syria, Palestine, Egypt, Ethiopic Africa, Madagascar.

Genus POMPILUS F.

1926. *Psammochares* Latr., Haupt, Psammoch. Europas, p. 150.
1937. *Psammochares* Arnold, Psamm. Ethiop. Reg., p. VII, p. 43.

Three radial cells present. Cu of fore wing not reaching margin, except in subgenus *Sericopompilus*. Transverse anal vein (Cut) of hind wing prefurcal or interstitial, angle formed with Cu pointed or right. Mandibles with one tooth at inner margin. Cheeks of varying length. Eyes larger than in the *Pedinaspini*. Pronotum normal, or calli and sulcus conspicuous. Lateral margins of scutum somewhat reflexed posteriorly. Propodeum mostly strongly convex, globose, declivity seldom flattened or slightly excavated, then the angles slightly and bluntly protruding (cf. subgenus *Sophropompilus*). Fore tarsi of female with comb of varying length. Claws dentate, rarely simple, in both sexes. In the male the interior claw of the fore tarsi has larger, somewhat forwardly directed basal tooth, only in a few species (including the type: *pulcher* F.) the male claw is symmetrical. Pulvillar comb varying in length and density.

The genus has more recently been divided into several *genera*. These are nothing more than species groups, at most subgenera. I am giving the main characteristics of them, as far as the Egyptian fauna is concerned, as follows :

1. *Pompilus* s.str. — Cu of fore wing not reaching margin. Body with grey pruinose pubescence, with fasciae or spots of denser pubescence on the abdomen. Eyes large. Comb spines of fore tarsi flattened, also lower comb spines present. Pulvillus large. Propodeum with well developed sulcus, not striate. Male with symmetrical fore claws and thick antennae.

Typical species: *pulcher* F.

Forming transition to genus *Dicyrtomellus* Guss. (sic!).

2. *Sericopompilus* How. — Cu of fore wing reaching apical margin; pterostigma rather large. Cut of hind wing joining Cu in a pointed angle, prefurcal, seldom vertical (right angle). Smaller species, with antennae and legs slender. Eyes large, about as broad as half of frons. Postnotum long. Propodeum smooth or transversely striate. Some parts of body with silky pubescence. Wings sometimes partly shaded, with extreme apex hyaline. Claws slightly dentate, fore claws of male asymmetrical. Terminal tarsal joint with or without lower spines.

Typical species : *apicalis* Say (N. America); characteristic Egyptian species : *gentilis* Klug.

3. *Arachnospila* Kincaid. — Cu of fore wing not reaching apical margin. Head and thorax with raised dark pilosity. Body usually black, wings infumated. Propodeum sulcate, but without transverse striation. Terminal joint of tarsi without rows of inferior spines. Comb of claws composed of 12 comparatively stout bristles. Fore tarsi of female with well developed comb. Male claws of fore tarsi asymmetrical. Larger species.

Typical species: *fumipennis* Zett.. Characteristic Egyptian species: *fallaciosus* m.

4. *Ridestus* Banks. — Dull species with whole or only anterior body usually reddish. Cu of fore wing not reaching margin. Pronotum with sulcus and conspicuous calli, hind margin depressed; in the male, pronotum not visibly narrowed towards apex. Propodeum with transverse striation. Claws comparatively long, dentate in both sexes. Comb of tarsi long. Ultimate tarsal joint with a double row of spines on under side. Pulvillus slender, shorter, spine comb weak. Large species.

Typical species: *biedermanni* Banks. Characteristic Egyptian species: *melas* Kl.

5. *Pareiocurgus* Haupt (= *Trichopompilus* Haupt). — Large species. Cu of fore wing not reaching apical margin. Body with long raised pilosity. *Genae long*. Clypeus not touching eyes. Claws dentate in the female, in the male the tooth is slightly directed forward. Comb of fore tarsi long. Spines on hind tarsi stout. Hind femora of female without preapical small spines, in the male only middle femora with rudimentary spines.

Typical species (also Egyptian) : *calidus* Guér. (*teterrimus* Grib.).

6. *Sophropompilus* How. — Cu of fore wing not reaching margin. Cut of wing nearly vertical at apex. Antennae short and stout. Propodeum slightly impressed at the declivity, with a slight callus laterally (cf. *Dicyrtomellus* Guss.). Claws slender, slightly dentate, comb of pulvillus small. Comb of fore tarsi developed.

Typical species: *ingenuus* Cress. Characteristic Egyptian species: *illiberalis* Haupt.

7. *Galactopterus* Arnold. — Cu of fore wing not reaching margin. Transverse anal vein hooked at apex. Wings with pronounced milky opacity. Body clothed with dense grey pubescence. Fore claws of male asymmetrical. Postnotum long, postscutellum vertical at apex. Small species. Female unknown.

Typical species : *rufipes* Arn. Egyptian species : *alfierii* nov.

8. *Ageniopompilus* subgen. nov. — Legs and antennae slender as in *Sericopompilus*. Metatarsus of fore leg without comb spines. Tibial spines very weak and scarce. Cell m3 of fore wing only indistinctly pointed at the proximal basal angle; Cu nearly or fully reaching apical margin of wing. Apical part of Cu of hind wing fairly evenly curved. Male unknown.

Forming apparently a transition to the *Macromerinae* (cf. *Pseudagenia*).

Typical species: *spiniprivus* spec. nov.

9. *Nanoclavelia* Haupt. — Wings usually milky white (not so in the spec. typ.). Cu of fore wing not reaching margin. Pubescence not so dense as in the former group, but propodeum mostly silvery pubescent. Abdomen of male short. Pterostigma large. Fore claws of male symmetrical, claws feebly dentate. Transverse anal vein (Cut) of hind wing vertical at apex. Basalis curved at the base. Small species.

Typical species : *leucopterus* Dahlb. Egyptian species : *aegyptorum* nov.

KEY TO EGYPTIAN SPECIES

Females

1 (2) Vein Cut of hind wing very strongly, about for the length of antennal joint 4, postfurcal, hook-like reflexed at apex. Very large, black species with at least reddish orbits and dark wings with blue lustre. Fore claws bifid, middle and hind claws dentate. Antennae black (or ferruginous : var. *bretoni* Guér.) .... cf. *Batozonellus fuliginosus* var. *vindicatus* Sm.

2 (1) Transverse anal vein at most slightly postfurcal, mostly interstitial of prefurcal. Fore tarsi (of female) dentate.

3 (4) Large black species with 2nd and following tergites *yellow*, margined with black. Wings yellow with black margins. Legs and antennae

long and slender. Sternite II with shallow transverse furrow beyond base. .... cf. *Ctenagenia vespiformis* (Klug)

4 (3) Abdominal segments not black and broadly yellow, but black or ferruginous (or red) or with grey fasciae of tomentum.

5 (20) Head and thorax, or at least the latter ferruginous, orange or dull red, or only prothorax in front and orbits red.

6 (7) Fore wings with two dark transverse bands, the 1st across basal vein, the 2nd across cell sc and cells r2 and r3, not quite reaching hind margin. Head and thorax red, frons dark, orbits red, sides of sternum and legs inclusive of coxae red, propodeum and abdomen dark. Propodeum with pubescence, declivous, little convex. Fore tarsi without comb. .... **fasciatellus spec. nov.**

7 (6) Fore wings wholly, or only at apex, darkened, or with broad preapical fascia, leaving tip hyaline, or wholly hyaline.

8 (11) Wholly ferruginous, at most propodeum, coxae and sterna blackish.

9 (10) Propodeum dark. Clypeus deeply emarginated. Wings infumated, hind wings paler towards base. 1st metatarsus with 4 comb spines. ....**rutilus Klug**

10 (9) The whole body pale ferruginous. Abdomen from segment III blackened. Antennae dark from joints 3 or 4 onwards. Legs and coxae orange. Wings moderately shaded, lighter at base. Three comb spines. Clypeus not excavated .... **croceus spec. nov.**

11 (8) Propodeum and abdomen dark.

12 (13) Wings yellow, with black apical margin, hind wings only in basal half with blackened margin. Large, black species. **cf. melas Klug**

13 (12) Wings not yellow.

14 (15) 1st metatarsus with six to eight very long flattened comb spines, besides, with a row of inferior comb spines. Large, black species with dull red anterior body and red orbits. Propodeum somewhat impressed posteriorly. .... cf. Genus *Dicyrtomellus* Guss.

15 (14) Anterior metatarsus with three to five comb spines. Medium-sized species.

16 (19) 1st metatarsus with four to five comb spines. Pronotum with calli and sulcus. Propodeum more or less distinctly transversely striate, like the abdomen black.

17 (18) Abdomen more or less brownish pruinose pubescent, with dark violet sheen in some direction. Antennae moderately slender. Ultimate comb spine about as long as 2nd tarsal joint. Temples (laterally) more than half as thick as the eye. .... **ruficeps Ev.**

a (b) Temples (in dorsal aspect) behind eyes more strongly arched, head across temples a little narrower than across eyes ; in lateral aspect the temples are little narrower than the eye. ....cf. **ruficeps Ev.**

b (a) Temples, in dorsal aspect, strongly narrowed posteriorly, flatly arched ; in lateral aspect they are much narrower than the eye. Comb spines somewhat longer. .**ruficeps aegyptiacus nov.**

18 (17) Abdomen distinctly greyish pruinose. Striation of the propodeum less conspicuous, irregular. Antennae very slender, joint 3 much longer than 1 and 2 combined. Head red with blackened arched spot below ocelli. Temples only half as thick as the eye. Ultimate comb spine shorter than 2nd tarsal joint. Eye distinctly somewhat broader than half of frons. .... **sinaiticus spec. nov.**

19 (16) 1st metatarsus with three comb spines. Body length 8-9 mm. Coloration as in *ruficeps,* but wings hyaline, with less than apical half infumated. Cell r3 less narrowed above. Propodeum with more or less defined sulcus, mostly transversely striate. Legs, at least 1st pair, dusky reddish. .... **masrensis spec. nov.**

20 (5) Anterior body black on the ground, rarely prothorax margined with yellow, or inner orbits with short reddish line, or the orbits are pale yellow.

21 (22) Hind margin of prothorax (sharply defined) and orbits *whitish yellow.* Wings hyaline, darkened at apex, the extreme apex again hyaline (not so in the male). Abdomen and legs ferruginous. Cu of fore wings reaching apical margin, cell r3 strongly narrowed above. Antennae and legs very slender. Small species. .. **gentilis Klug** (6)

22 (21) Prothorax unicolorous or hind margin and sides narrowly ferruginous (not conspicuously whitish yellow). Not both orbits pale yellow.

23 (24) Clypeus narrower than frons, with nearly parallel sides, smooth, shining, somewhat punctured anteriorly. 2nd to 4th fore tarsal joints comparatively short. Abdomen somewhat compressed at apex. Body black or abdomen reddened at base. ...... cf. genus *Pedinaspis* Kohl

24 (23) Clypeus as broad as frons or, if narrower, not smooth and shining, not rectangular in front, more or less pubescent.

25 (54) Abdomen wholly or partly red or ferruginous.

26 (27) Legs comparatively short and stout, hind tarsi little longer than hind tibiae ; middle and hind femora and tibiae ferruginous, tarsi dark. Abdomen ferruginous, slightly darkened towards apex. Sides of scutellum, thorax and propodeum with silky whitish pruinose pubescence. Cell r3 narrow above. Three moderately long comb spines.

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(6) cf. *seminiger* Taschb., Haupt (Abessinia, Palestine), Outer orbits not yellow. Ultimate comb spines longer than 2nd tarsal joint. Wings of male of the same pattern as of female.

Antennae comparatively short and stout. Vein Cut of hind wing somewhat postfurcal (in the similar *arens* prefurcal). .... cf. *Anospilus compactus* nov.

27 (26) Legs normal or very slender, Hind tarsi decidedly longer than tibiae.

28 (31) Abdominal segments with *apical* fasciae of whitish grey pubescence.

29 (30) Cell r3 almost closed above. Ultimate tergite with conspicuous stout black bristles. .... cf. genus *Anoplius* Duf.

30 (29) Cell r3 high, parallel-sided, rectangular (Fig. 14). Fore wings with broad submarginal fascia, tip narrowly hyaline. Cell r2 strongly narrowed above. Abdominal segments I and II ferruginous, these, or also III, with narrow grey apical fascia. Three comb spines. .... **arcanus spec. nov.**

31 (28) Abdomen without conspicuous grey fasciae, but sometimes segment III or also II with illdefined grey basal bands, or the abdomen wholly uniformly pubescent.

32 (33) Abdomen with fine grey basal bands on tergites II and III, apical portion with brown pubescence. Pronotum at fore and hind margin with fine grey fascia, also thorax with spots of such pubescence. Antennae short and stout. Cell r3 narrow above. Abdominal segments I, II and III red at base. Propodeum at the sides posteriorly slightly and bluntly produced. .... **illiberalis Hapt**

33 (32) Abdomen without basal fasciae of paler pubescence. Propodeum behind not bluntly angular.

34 (35) Cell r3 of fore wing high, parallel-sided (Fig. 14). Wing tip, exteriorly of apical darkening, hyaline again. Propodeum slightly transversely rugose posteriorly. Antennae and legs slender .... **cf. arcanus spec. nov.**

35 (34). Extreme tip of wing not hyaline. Cell r3 more or less narrowed above, even if higher than long.

36 (37) Cell r3 very small and narrow, with *long petiole* (Fig. 16). Fore metatarsi with three yellow comb spines. Genae well developed. Body with very dense decumbent yellow-grey pilosity. Abdomen and legs (except base of femora) ferruginous. Length 5.5 mm. .... **cf. Leuchimon petiolatus spec. nov.**

37 (36) Cell r3 not petiolate.

38 (41) Cell r3 narrow, higher than long, narrowed towards fore margin of wing.

a (b) Anterior metatarsus without conspicuous comb spines ; the small spines are shorter than the apical width of the metatarsus. Legs and antennae very slender. Cell m3 of fore wing not distinctly pointed. Tibial spines weak. .... **spiniprivus spec. nov.**

b (a) Comb spines of anterior tarsi well developed.

39 (40) Three comb spines of metatarsus, the ultimate spine somewhat shorter than 2nd tarsal joint. Clypeus laterally nearly attaining eyes. .... *Anospilus compactus* spec. nov.

40 (39) Four to five comb spines of metatarsus. Pubescence of body very dense so that the ground is wholly covered. Wings with sharply defined black apical spot. Cheeks long, clypeus laterally not reaching eyes. .... cf. genus *Leuchimon* Haupt (spp. *mochii* and *haupti*)

41 (38) Cell r3 normal, in any case not higher than long ; it is at base as long as or longer than Rt2, if it is more strongly narrowed above.

42 (49) Femora and tibiae wholly ferruginous. Postnotum long (7). Species having hyaline wings with apex infumated, and slender antennae and legs.

43 (44) Anterior metatarsus with 4 long comb spines, the apical of which surpassing joint 3 for half of its length. Head and thorax with whitish grey silky pubescence. Propodeum transversely rugose, with median sulcus. Cu of fore wing does mostly not quite reach the margin. .... **desertorum spec. nov.** (8)

44 (43) Anterior metatarsus with mostly *three* comb spines, last spine not reaching apex of 2nd tarsal joint. Inner orbits sometimes with indistinct reddish line.

45 (46) Cu of fore wing not reaching margin. Postnotum not visible in the middle. Legs and antennae stout. Body densely clothed with silvery pubescence. Nervulus postfurcal .... **arens spec. nov.**

46 (45) Cu of fore wing fully reaching margin. Legs and antennae very slender. Postnotum as long as or somewhat longer than postscutellum.

47 (48) Propodeum at the sides distinctly finely striate. The apical comb spine of the 1st metatarsus surpasses slightly the middle of the 2nd tarsal joint. .... **arenicola spec. nov.**

48 (47) Propodeum not transversely striate. Comb spines a little shorter, the apical spine hardly reaching the middle of the 2nd tarsal joint. .... **arenicola meadiensis nov.**

49 (42) Legs dull red or with black line exteriorly or wholly black, or the femora are distinctly blackened at base.

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(7) cf. *Anospilus compactus :* Postnotum only laterally visible, legs and antennae stout, ocelli forming an obtuse angle.

(8) Similar is probably : *P. fuscipennis* Haupt (Palestine). Cell r3 short. Ocelli forming obtuse angle. Wings slightly infumated, with dark apex, and dark spots in cells sc, r2 and r3.

50 (51) Only 1st and base of 2nd tergite red. Body and legs with long black pilosity. Comb spines not longer than metatarsus, broad at apex. 11-12 mm. (Not yet recorded from Egypt). (cf. *punicus* Haupt)

51 (50) Not the above characters combined.

52 (53) Apical comb spines of 1st metatarsus reaching apex of 2nd tarsal joint. Propodeum with transverse rugae, declivity with fine median carina. Hind femora somewhat lighter than the others, paler or darker ferruginous. .... **rhodosoma Kohl**

53 (52) Apical comb spine reaching middle of 2nd tarsal joint. Propodeum almost smooth. Legs black. .... **elbanus spec. nov.**

54 (25) The whole body beneath the pubescence black ; sometimes with grey fasciae on the hind margins of the segments, or some segments indistinctly reddened at hind margin.

55 (62) Abdomen with conspicuous fasciae or lateral spots of greyish pubescence, tergite I sometimes wholly grey pruinose, the following only at base narrowly black ; or only 1st and 2nd tergite grey apically, otherwise with brownish pruinosity.

56 (57) Legs red, also middle and hind coxae red exteriorly, tarsi more or less darker. Anterior metatarsus with four long comb spines. Cell r3 shorter than r2, strongly narrowed above (Fig. 15). The grey marginal bands of the abdomen illdefined, broad. Propodeum smooth, shining, with median sulcus. (In the male only 1st and 2nd tergite with apical grey pubescence, 3rd and following segments brown pubescent). .... **astutus spec. nov.**

57 (56) Legs dark.

58 (59) At least head and prothorax with raised black pilosity ; abdominal segments with grey apical fasciae. Vein Cut of hind wing vertical at apex, postfurcal. (Female yet unknown). . **tomentosus spec. nov.**

59 (58). Head and prothorax without conspicuous raised pilosity.

60 (61) Cell r3 strongly narrowed above. Abdominal tergites II-V at hind margin more or less broadly with grey, segment VI with brown, pubescence. (Male almost wholly grey pubescent). Pronotum and scutellum at the sides with denser and paler pubescence than in the middle. Calcaria of tibiae yellowish. Wings darkened at apex. .... **pulcher F.**

61 (60) Cell r3 narrow, high, even somewhat broader above than below. Abdominal segments I and II with narrow grey apical fascia. Propodeum finely transversely striate. Wings slightly infumated with dark sub apical band, tip white. Calcaria black. .... **khargensis spec. nov.**

62 (55) Abdomen without grey fasciae, but often a whole segment evenly grey or brownish pruinose, or several segments so.

63 (64) Wings yellow, apices with black margin. Four comb spines. Large species. .... **melas Klug**

64 (63) Wings not yellow.

65 (80) Wholly black species, often with raised pilosity on head and propodeum, sometimes also on thorax and 1st abdominal tergite. Orbits seldom with short reddish line. Wings nearly always strongly infumated. Length 7.5-22 mm.

66 (67) Anterior metatarsus with five long, fine, *testaceous* comb spines, of which the apical one reaches at least the middle of the third tarsal joint. Body with fine brown pruinosity, without raised hairs. Cell r3 much narrowed above, there only one-fourth to one-third as long as cell r2. .... **kochi spec. nov.**

67 (66) Comb spines dark.

68 (77) Anterior metatarsus with *four* to *five* comb spines.

69 (70) Vein Rt1 of fore wing almost rectangularly broken (Fig. 10). Pterostigma large, cell sc comparatively short. Propodeum short, not transversely striate. Antennal joint 3 about as long as the thick joint 1. Basal comb spine (spine 1) short. Genae moderately long. Raised pilosity moderately long. Comb bristles of pulvillus sparse. Length 8.5-9 mm. .... **mareoticus spec. nov.**

70 (69) Vein Rt1 of fore wing not angularly broken, only curved. Wholly black species with wings usually with violet lustre. Antennal 3 mostly longer. Comb spines of pulvillus numerous. Length 8-22 mm.

71 (72) Genae long. Body with long and dense raised pilosity. Apical comb spine of 1st metatarsus reaching apex of 2nd tarsal joint or surpassing it. Wings with blue lustre. Large species. .... **calidus Guér.**
(*teterrimus* Grib., *atrohirtus* Kohl)

72 (71) Genae shorter. Body less dense and long pilose. Propodeum somewhat flattened behind or slightly impressed.

73 (74) Wings with distinct blue lustre. Temples, in lateral aspect, short, less than half as thick as the eye. Orbits never with brownish streak, Position of ocelli nearly acute-angular. Frons above between eyes narrower than below. Cell r3 above one-fourth to one-third as broad as below (Fig. 9). .... **mimus spec. nov.**

74 (73) Wings without blue lustre. Temples, in lateral aspect, strongly widened downwards, below more than half as thick as the eye. Orbits mostly with yellowish line in the excavation of the eye. Ocelli forming a right or slightly obtuse angle. Frons below little broader than above.

75 (76) Cell r3 very narrow above, less than one-fourth as long as below (Fig. 11). Antennal joint 3 little longer than 1 (scape). Inferior

comb spines wanting. Length 8.5-10.5 mm. .. **litorellus spec. nov.**

76 (75) Cell r3 above one-fourth to one-third as broad as below. Antennal 3 longer than 1 and 2 combined. Besides the lateral comb spines, there are 3 very short lower comb spines present. Length 13-15 mm. .... **fallaciosus spec. nov.**

77 (68) 1st metatarsus with *three* short or moderately long comb spines that do not reach the apex of the 2nd tarsal joint. Temples well developed. Antennal joint 3 as long as 1 and 2 united.

78 (79) Propodeum at the declivity with very fine transverse sculpture, otherwise roughened. Cell r3 above one-half (or somewhat less) as long as below. Temples narrow. Body (inclusive of legs) with strong raised black pilosity. Length 7.5-8.5 mm. .... **calidellus spec. nov.**

79 (78) Propodeum without visible sculpture. Cell r3 above scarcely one-third as long as below. At the outer orbits a short brown line. Temples thick. Length 15 mm. .... **anubis Haupt**

80 (65) Smaller species without conspicuous raised pilosity, having either hyaline or only apically infumated wings.

81 (82) Species having milky white wings. (Females unknown). .... cf. *aegyptorum* n. sp., *alfierii* n. sp. and *nubicus* n. sp.

82 (81) Wings strongly shaded towards apex or with black apical spot or submarginally darkened, in any case not with distinct milky opacity. (Females unknown). .... cf. *signatipennis* Kl., *mochianus* sp. n. and *murinus* sp. n.

Males (9)

1 (20) At least the head red or brown, or black with red orbits. Prothorax seldom with yellow posterior margin, but often the hind margin or angles ferruginous.

2 (3) Very small species. Vertex sharply edged. Antennae filiform, yellow. Pterostigma very large, only slightly shorter than cell sc at fore margin. Body wholly pale brown, shining. .... cf. genus *Micropompilus* nov.

8 (2) Larger species. Vertex not sharply margined posteriorly.

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(9) In most species of *Pompilus* the interior claw of the fore tarsus possesses a stout, forwardly directed basal tooth so that the inner claw often appears bifid, the outer claw is dentale or simple (Fig. 5). Only in the species *pulcher* F., *aegyptorum* nov. and *signatipennis* Klug the fore claws are symmetrical.

The males of *Pedinaspis* are, according to Haupt, not easily to distinguish from those of certain *Pompilus* species, but have more strongly pilose head and prothorax, and the clypeus is at base always somewhat narrower than the frons. The vertex is behind the ocelli always more convex. Unfortunately I have not yet seen any males of the Egyptian *Pedinaspis* species, although they occur in the north and in Sinai.

4 (5) Wings milky white, without apical darkening. Legs ferruginous. Body with dense and decumbent grey pubescence. Base of antennae ferruginous. Abdominal segments 4-6 with brown pubescence ; segment 7 whitish. .... **nubicus spec. nov.**

5 (4) Wings partly dark, especially so the apical margin, or wings wholly dark.

6 (9) Body ferruginous with either the propodeum or the apex of the abdomen dark.

7 (8) Only the propodeum dark. Clypeus distinctly emarginated .... **rutilus Kl.**

8 (7) Whole body red, only posterior abdominal segments dark. .... **croceus spec. nov.**

9 (6) Anterior portion of body dull red to blackish red, at least the inner orbits ferruginous. Scutum and scutellum more or less dark.

10 (11) Wings yellow, with black apical margin, hind wings also at hind margin black. Large species. .... **cf. melas Kl.**

11 (10) Wings not yellow, mostly hyaline with darker apex, or wholly dark.

12 (15) Small species with large pterostigma, comparatively short abdomen and pale (whitish) tergite VII, though the latter may be concealed.

13 (14) Wings hyaline with broad subapical dark margin, tip hyaline. Propodeum with dense, decumbent silky pilosity. .... **waltli Spin.**

14 (13) Wings hyaline, with apical third infumated. Propodeum less densely and not conspicuously pilose. (Palestine). .... cf. *ruficollis* Haupt

15 (12) Larger species. Wings not hyaline at extreme apical margin.

16 (19) Cheeks short. Pterostigma conspicuous. Cell r3 little narrowed above.

17 (18) Anterior body red or dusky red. Propodeum posteriorly at the sides with some transverse striae. Antennal joint 3 three times as long as 2. .... **ruficeps Evers.**

18 (17) Body wholly black, only both orbits reddened. Propodeum entirely smooth, dull. 3rd antennal joint at most 2.5 times as long as the 2nd. .... **spec.**

19 (16) Genae long. Pterostigma small, narrow. Cell r 3 strongly narrowed above. .... cf. genus *Dicyrtomellus.*

20 (1) Anterior body black, orbits not reddened (seldom in the small species *arenicola* a reddish line in the excavation of the eye), orbits sometimes whitish yellow, in this case also pronotal hind margin distinctly yellow.

21 (22) Inner and outer orbits and hind margin of pronotum sharply defined *yellow.* Slender species with thin legs and antennae. Abdomen ferruginous. Cu of fore wing attaining lateral margin. ... **gentilis Kl.**

22 (21) Hind margin of pronotum not conspicuously whitish yellow, at most the margin laterally somewhat ferruginous.

23 (28) Wings with milky white opacity, apex not darkened. Stigma large.

24 (25) Fore tarsi with long comb of yellow, basally black, spines. Abdomen long, slender. Antennae stout, nearly club-shaped. The whole body with very dense, decumbent grey pilosity. .... cf. genus *Chionopompilus* nov.

25 (24) Fore tarsi without comb.

26 (27) Legs ferruginous. Abdominal segments with grey, segments IV and V with brown, pubescence. Interior claw of fore tarsi with *stout* basal tooth. .... **alfierii spec. nov.**

27 (26) Legs dark. Abdomen evenly and finely, less densely grey pruinose, so that the body appears more black than grey. Claws of fore tarsi symmetrical. .... **aegyptorum spec. nov.**

28 (23) Wings not distinctly milky white, in any case apically or wholly dark, or with preapical fascia so that the tip remains hyaline.

29 (42) Some or all abdominal segments with fasciae of grey pubescence that contrast distinctly from the brown or blackish pruinose rest.

30 (35) Abdomen partly ferruginous.

31 (34) Abdomen with apical fasciae of grey pubescence.

32 (33) Cell r 3 closed anteriorly. Wing tip not hyaline. .... cf. *Anoplius tenuicornis* spec. nov.

33 (32) Cell r 3 high, rectangular, parallel-sided. Wings again finely hyaline at extreme apical margin. .... **arcanus spec. nov.**

34 (31) Abdomen with *basal* fasciae of grey pruinosity or pubescence. Propodeum posteriorly on either side somewhat bluntly produced. Pronotum with greyish pubescent fore and hind margin. Antennae short and stout. .... **illiberalis Haupt**

35 (30) The whole body black on the ground. Legs black or partly ferruginous.

36 (39) Pterostigma well developed. Propodeum convex. Head and prothorax without raised dark pilosity.

37 (38) Calcaria of tibiae yellowish (more or less shaded). Claws of fore tarsi symmetrical. Slender species, abdomen longer than thorax, narrow. Propodeum with conspicuous longitudinal sulcus. .... **cf. pulcher F.**

38 (37) Calcaria black. Abdomen stout, somewhat shorter than thorax. Propodeum only in front slightly sulcate. Interior claw of fore tarsus with *stout* basal tooth, claws asymmetrical. .... **astutus spec. nov.**

39 (36) Pterostigma smaller. Body sometimes with raised pilosity. Pale

grey pruinosity of the abdomen narrower than dark portion or consisting of lateral spots. Legs black.

40 (41) Head and sides of propodeum with raised black pilosity. Propodeum posteriorly with distinct declivity. .... **tomentosus spec. nov.**

41 (40) Without raised pilosity. Propodeum more flattened, towards apex evenly declivous. .... cf. genus *Pompiloides* Rad.

42 (29) Body either evenly greyish pubescent or pruinose, not fasciated, or pruinosity extremely fine, indistinct.

43 (52) At least one abdominal segment ferruginous.

44 (45) Pterostigma small. Propodeum behind at the sides somewhat bluntly produced. Cell r3 closed above or nearly so. Legs black. .... cf. *illiberalis* Haupt

45 (44) Pterostigma normal. Propodeum quite evenly convex. Cell r 3 not or seldom wholly closed anteriorly (10)

46 (47) Legs wholly black (Palestine). .... cf. *extraneus* Haupt

47 (46) Legs not wholly black.

48 (49) Legs and antennae very slender, joint 3 of the latter more than three times as long as 2. Abdomen slender, nearly longer than the thorax, almost wholly ferruginous, apex darkened, tergite VII yellow-white. Cut of hind wing joining Cu in a pointed angle. Antennals 1 and 2 ferruginous. Postnotum at least as long as the postcutellum. Cu of fore wing reaching apical margin. .... **arenicola spec. nov.**

49 (48) Legs and antennae stouter. Abdomen shorter than the thorax, tergite I with black spot at base. Cu of fore wing mostly not reaching margin. Cut of hind wing steeper at apex.

50 (51) Antennal joint 3 somewhat longer than 2. Legs partly darkened, sometimes only the hind femora ferruginous. Apical (VIIth) tergite whitish. .... **rhodosoma Kohl**

51 (50) Antennal 3 twice to 2.5 times as long as 2. All legs with trochanters and tips of coxae ferruginous. Base of antennae pale beneath. Cell r3 strongly narrowed anteriorly. Pterostigma pale brown. Wings only slightly shaded at apex. .... **curtiventris spec. nov.**

52 (43) The whole body black on the ground, at most the apical margins of some abdominal segments narrowly reddish transparent.

53 (56) Legs more or less ferruginous.

54 (55) Wings hyaline, with broad subapical fascia, extreme margin narrowly hyaline. Pterostigma large. Orbits reddened. Vein Cut of hind wing joining Cu vertically. .... **waltli f. specialis nov.**

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(10) To this section would also lead the males of the genus *Leuchimon*. They have cell r3 narrowed above and high, and the body with very dense adpressed pilosity. Genae conspicuous. Tegulae and calcaria yellow.

55 (54) Wings with the whole apical margin blackened, the darkening entering partly the exterior cells. Head wholly black. (Palestine). .... *saucius* Haupt.

56 (53) Legs and antennae black, at most knees pale.

57 (58) Bases of abdominal tergites very narrowly black, bare, rest grey pruinose. Calcaria of hind legs mostly yellowish. Pubescence very fine, pruinose. Abdomen long and slender. Antennae longer than thorax, stout. Claws of fore tarsi with equal teeth. ... **pulcher F.**

58 (57) Not the above characters combined.

59 (62) Wings yellow with black margins. Large species.

60 (61) Body wholly black, only orbits reddened. .... **cf. melas Kl.**

61 (60) 2nd and following abdominal segments yellow, with narrow black margins. .... **cf. Ctenagenia vespiformis (Kl.)**

62 (59) Wings not yellow, at most the veins at base yellowish.

63 (64) Large species with strong, raised, black pilosity on head, prothorax and propodeum. Body wholly black with strongly infumated wings. Tooth of claws somewhat directed forward, basad. Cheeks well developed. .... **calidus Guér. (teterrimus Gr.)**

64 (63) Smaller species without raised pilosity. (The unknown males of the subgenus *Arachnospila* also come in this group).

65 (66) Body with dense, conspicuous yellow-grey decumbent pubescence. Hind margins of abdominal segments reddish transparent. Antennae stout. Genae conspicuous. Abdomen short. Veins of hind wing yellowish. .... cf. *Leuchimon griseoflavus* spec. nov.

66 (65) Pubescence more pruinose, not like adpressed hairs. Legs black.

67 (70) Wings with dark apical margin, the extreme tip remaining narrowly hyaline. Vein Cut of hind wing vertical at apex, interstitial or somewhat postfurcal.

68 (69) Antennal joint 3 about four times as long as 2, joint 1 almost globular. Pterostigma large. Tergite VII white. Claws of fore tarsi symmetrical. .... **signatipennis Kl.**

69 (68) Antennal 3 about as long as 2. Body very densely and finely grey pubescent. Stigma smaller. .... **cf. murinus spec. nov.**

70 (67) Wings with dark apical margin or slightly shaded at apex, not hyaline at extreme margin.

71 (72) Cell m3 of fore wing having proximal lower angle not pointed. Legs and abdomen slender. Tergite VII dark, like the rest of the abdomen. Vein Cut of hind wing joining Cu in a pointed angle. Propodeum only laterally and posteriorly more densely silvery pubescent, seemingly bare in the middle. .... **sayedi spec. nov.**

72 (71) Cell m3 of fore wing pointed at the proximal lower angle. Propodeum

evenly pubescent. Antennae shorter and stouter, joints 2 and 3 subequal in length.

73 (76) Vein Cut of hind wing slightly curved at apex, joining Cu in a pointed angle.

74 (75) Pronotum broadly emarginated at hind margin. Wings not paler at extreme apical margin. Postnotum well visible. Distance of hind ocelli little longer than that between them and eye. Propodeum normal. Length 6 - 6.5 mm. .... **mochianus spec. nov.**

75 (74) Pronotum little emarginated posteriorly. Postnotum short, little visible. Distance of ocelli twice as long as that between hind ocellus and eye. Propodeum slightly impressed behind, with visible hind angles. Fore wings with an indistinct hyaline extreme apical margin. 4 - 6.5 mm. .... **murinus spec. nov.**

76 (73) Vein Cut of hind wing circularly curved at apex, prefurcal. Tergite VII white. Length 8 mm. (Palestine). .... cf. *similis* Haupt

Subgenus Pompilus s. str.

Pompilus pulcher F.

1926. *Pompilus plumbeus* f. *pulchra* Haupt, Psamm. Europas, p. 181.

Female: 5-12 mm. — Black with grey pubescence that in the Egyptian specimens is rather dense, leaving on the abdomen only narrow basal bands to brownish pubescence, the grey fasciae are in our specimens never interrupted in the middle. Scutellum in the middle with brown, at the sides with grey, pubescence. Calcaria of tibiae yellowish, often shaded with grey. Wings scarcely shaded in proximal portion, with broad apical darkening that does not follow the margin but is truncate interiorly.

Inner orbits almost parallel, emargination above middle feeble. The eye is as broad as about three-fourths of half of frons. Temples, in lateral aspect, half as thick as the eye. Frons with well developed median line. Ocelli forming a pointed angle, pol = ool. Fore margin of clypeus a flat arc. Antennal joint 3 as long as 1 + 2, about four times as long as thick. Promotum with obtusely angled hind margin. Notauli curved outward in front of scutellum. Postnotum deepened, about half as long as postcutellum. Propodeum strongly convex, with conspicuous longitudinal sulcus. Basal vein strongly curved below ; cell r2 below somewhat longer than r3, veins Rt1 and Rt3 curved ; in small specimens cell r3 may be closed above ; Cut 1 interstitial ; Cu of fore wing does not attain the apical margin ; Cut of hind wing joining Cu in a pointed angle, prefurcal. Comb of tarsi long, spines somewhat flattened, metatarsus with three of them, and with two fine inferior comb spines. Raised pilosity on anterior body scarcely developed.

Longer calcar of hind tibiae two-thirds to three-fourths as long as metatarsus. Apical joint of middle and hind tarsi without inferior rows of spines. Pulvillus well developed, comb bristles stout and dense, somewhat surpassing pulvillus.

Male: The base of the tergites is still more narrowly dark, linear, so that the abdomen appears almost evenly grey pubescent. Antenae comparatively thick, very slightly widened towards apex. Claws of fore tarsi symmetrical. Genital plate narrowed towards apex, almost pointed, with distinct keel, provided with comparatively long bristles that are directed obliquely backward, and conspicuous in profile.

Habitat: The species is fairly common in Egypt. It was collected in the north (e.g. Marsa Matrouh, Alexandria, Siouf, Abukeer), in the Suez Canal area (Ismailia), in the Delta (Mansuriah, Abu Rowash, etc.), in Middle Egypt (Cairo, Meadi, Helwan, Beni-Youssef) and also at Asswan in Upper Egypt. All the year round. It prefers sandy localities (dunes).

P. pulcher occupies a rather isolated position amongst its congeners, especially owing to the somewhat broadened and flattened comb spines of the fore tarsus of the female, the dense, well developd pulvillar comb, the symmetrical fore claws of the male and its stout, towards apex not attenuated, antennae. It certainly shows affinities to the type of the genus *Dicyrtomellus* (*luctuosus* Mocs.).

Subgenus Sericopompilus How.

Pompilus gentilis Klug

1843. *Pompilus gentilis* Klug, Symb. phys., pl. 39, fig. 2 (female).

Female: 6-8.5 mm. — Anterior body black. Clypeus yellowish white anteriorly, mandibles yellow ; yellowish white are also the orbits, the collar of the prothorax, and often 2 small transverse spots at the sides, and broadly the whole posterior margin of the prothorax. Abdomen and legs pale ferruginous, coxae and partly trochanters dark. Tarsi ferruginous, darkened at tip. Wings hyaline, with dark veins, broad dark subapical fascia, apex therefore hyaline.

Antennae and legs long and slender, anterior body clothed with fine, grey little dense pubescence. Abdomen pruinosely grey pubescent. Antennal joint 2 longer than broad, 3 longer than 1 + 2. Frons with median line. Distance of hind ocelli greater than that between ocelli and eyes. Postnotum as long as postscutellum, with median line, pubescent. Pterostigma well developed, cell r3 narrow anteriorly, r2 elongate. Cu of fore wing reaching apical margin. Vein Cut of hind wing joining Cu at a pointed angle, somewhat prefurcal. Comb spines ferruginous, not very long, last spine of the three of the metatarsus as long as the 2nd tarsal joitnt or scarcely shorter. Lower comb spines wanting. Calcaria of tibiae *pale,* long. Under side of tarsi without spines. Pulvillus oval, with few comb bristles. Claws dentate.

Male: 5-7 mm. — Very similar to the female, and from similar slender-legged species easily distinguished by the yellow margin of the prothorax, which is narrower than in the female. Tarsi mostly wholly dark. Collar often only at the sides with yellow dot. Cell r3 in some specimens broader anteriorly than usual, only little narrower than r2. Wings less strongly shaded at apex, but the darkening reaching the apex of the wing.

Habitat: Common, especially in the desert valleys. Localities: Dekheila, Fayed ; Abu Rowash, Kerdasa, Marg, Cairo, Meadi, Wadi El-Tih, Wadi Digla, Wadi Hof, Wadi Gharaid.

Pompilus rhodosoma Kohl

1886. *Pompilus rhodosoma* Kohl, *Verh. zool. bot. Ges. Wien,* 36, p. 321.
nec *P. rhodosoma* Haupt = *seminiger* Taschb., Pomp. Palästinas, MS.

Female: 5-11 mm. — Black ; antennae black, abdomen red, apex sometimes darkened, legs dull red or blackish, mostly the hind femora palest, especially at posterior margin and at apex, seldom wholly dull red, hind tibiae dull red or wholly dark. Pubescence silvery grey, somewhat more conspicuously on the lower frons, prothorax, postscutellum and propodeum ; scutum and scutellum dorsally more brownish pubescent ; the pubescence is, excepting the frons, not very dense, the ground is well visible. Wings mostly slightly, but always distinctly shaded, darker towards apex, a darker apical margin is often not separated. Temples with whitish raised and decumbent pilosity.

Head distinctly broader than long, eye as broad as or somewhat broader than half of frons, inner orbits very slightly narrowed towards vertex, eyes scarcely emarginated ; temples, in lateral aspect, very short, about one-third as thick as the eye. Genae very short, clypeus touching eyes laterally. Ocelli forming a right angle, (pol) subequal to (ool). Head and prothorax with only very few raised hairs. Antennal joint 3 longer than 1 + 2. Prothorax convex, short, hind margin broadly excavated, dorsum without sulcus or marginal depression. Postnotum more than half as long as postcutellum, transversely striate, pubescent, with median foveola or sulcus. Propodeum short, convex, declivous portion a little longer than horizontal one, *surface transversely striate,* sometimes with short median carina posteriorly ; declivity posteriorly in the middle often somewhat shining, with 2 foveolae. Venation normal, vein Cut1 interstitial or slightly postfurcal, veins Rt1 and Rt3 slightly curved, cells r2 and r3 of equal size ; cell sc about as high as cells r. Pterostigma normal, dark. Transverse anal vein (Cut) of hind wing, vertical upon Cu, very slightly prefurcal. Fore tarsi with dark comb spines, the apical one of the metatarsus about as long as the 2nd tarsal joint. Long calcar of hind tibiae as long as or a little longer than half of metatarsus ; apical tarsal joint on the under side with double row of small spines, that are wanting in the male ; pulvillus small, slender, basal plate transverse, with a few short bristles. Claws distinctly dentate.

Male : 4-7 mm. — Shortly built, with short, stout antennae. Abdomen shorter than thorax, elliptical, red with black basal spot on tergite 1, or abdomen partly blackened (in small specimens) ; hind femora red, rest of legs black, the hind femora are sometimes only at the hind margin paler. Tergite VII testaceous to yellow-white. Antennal 3 somewhat longer than 2. Cu of fore wing not quite reaching margin.

Habitat: This species occurs chiefly in the desert valleys, the male is common, visiting the inflorescences of *Pennisetum dichotomum*. Localities: Kafr El-Harama, Kerdasa, Ain Musa, Cairo, Pyramids, Wadi Digla, Wadi Hof, Helwan. From iv to x.

Haupt puts *P. rhodosoma* Kohl as a synonym to *seminiger* Taschb. (sensu Haupt), but it does not agree with the description given by Haupt (l.c.). The latter species has ferruginous orbits and margin of pronotum, legs from coxae uniformly ferruginous, wings paler at extreme apex, (pol) distinctly longer than (ool), and the apical comb spine of the metatarsus is longer than the 2nd tarsal joint. *P. seminiger,* as described by Haupt, comes much closer to *arenicola* nov. spec.

Pompilus desertorum spec. nov.

Female : 6.5-9 mm. — Head and thorax black, fore margin of clypeus and the mandibles yellowish, tips of coxae and under side of them mostly ferruginous, abdomen wholly ferruginous, only tergite 1 with black basal spot, antennae reddened beneath, *all femora and tibiae ferruginous,* middle and hind tarsi slightly brownish towards apex ; tegulae yellowish. Wings nearly hyaline, also about cell sc only slightly infumated, with broad dark margin beyond the cells, apex of wing paler again, but not purely hyaline. Anterior part of body *densely* covered with yellowish-grey decumbent pubescence, that on the abdomen becomes more pruinose and appears pale brownish.

Eyes as broad as or only slightly narrower than half of frons, interior orbits a little parallel below ; eyes slightly but distinctly emarginated above, thus the orbits narrowed again towards the vertex. Temples, in lateral aspect, less than half as wide as the eye. Clypeus normal. Genae very short. Body without raised hairs. Position of ocelli about rectangular, (pol) : (ool) = 3:2 or the former still longer. Antennae slender but shorter than in *arenicola,* joint 3 somewhat longer than 1+2. Prothorax rather convex, hind margin moderately emarginated in an arc, a median sulcus is indicated only posteriorly, by the laterally directed pubescence. Scutellum little convex longitudinally. Postnotum narrow, length one-third of postscutellum. Propodeum evenly convex, slightly impressed at the declivity, here with feeble carina, surface at the sides and behind distinctly transversly striate, also in the middle. Apex of abdomen with a few fine erect pale hairs. Pterostigma well developed, 2nd abscissa of R more than twice as long as 1st, 3rd distinctly shorter than 2nd ; cells r2 and r3 subequal in length below ; Rt1 and Rt3 curved, the latter sometimes with median appendage ; Cu of fore wing not reaching lateral margin : vein Cu1 interstitial, nearly vertical ; Cut of hind wing strongly curved, sometimes nearly angularly so, vertical upon Cu or even bent backward apically, distinctly prefurcal. Fore tarsi with *very long comb spines* which are yellow, the last spine of the metatarsus attaining nearly the end of the 3rd tarsal joint. The spines are somewhat flattened and 4 in number ; between the long comb spines there are normally two small spines ; inferior spines wanting. Calcaria of hind tibiae yellow, about half as long as the metatarsus. Middle and hind tarsi on the under side with a paired row of fine spines. Claws long, with conspicuous tooth, pulvillus slender, less than half as long as the claw.

Male unknown.

Habitat: 3 females, Wadi Digla, 17.iii.1931 ; 1 female, Fayed, viii-ix (leg. H. Priesner).

This species cannot be identical with Haupt's *P. seminiger* Tasch. (Pomp. Palästinas, MS), because the latter has only 3 comb spines, and its orbits and prothorax are margined with red.

Pompilus arenicola spec. nov.

Female: 6.5-9 mm. — Varying in size, sculpture of the propodeum and also the length of the comb spines. Antennae, head and thorax black. 1st antennal joint often reddish, mandibles yellow, palpi brownish. Inner orbits sometimes with short pale line. Abdomen pale ferruginous, tergite I at base often with a *small* black spot. Coxae black, tips (or more) ferruginous, femora and tibiae wholly ferruginous (in one specimen the margins of middle and hind femora darkened (f. *fuscifemoralis* nov.); tarsi darkened to black. Anterior body with whitish silky pubescence, especially the head in front, prothorax, propodeum and sides of sterna; the ground is mostly visible, so that the anterior body appears grey. Wings hyaline at base, more or less infumated towards apex, so that also cells sc and r become more or less darkened; hind wings slightly darkened at apex.

Eyes large, broad, broader than half of frons, orbits below nearly parallel, or only very slightly converging towards vertex, eyes slightly but distinctly emarginated, frons above between eyes much narrower than below. Genae very short, clypeus touching the eyes, very slightly emarginated in front. Ocelli forming a right angle, (pol) : (ool) = 3:2. Ocelli large. Frons with fine median line. Temples, in lateral aspect, less than half as thick as the eye. Antennae long and slender, joint 3 much longer than 1+2. Pronotum convex, with very feeble median sulcus and indistinct marginal depression. Scutellum convex, sides not edged. Postscutellum short, *postnotum longer than postscutellum,* with median sulcus and laterally visible transverse striation. Propodeum in the middle and at the sides with fine transverse striation that is finer than in *P. rhodosoma;* a smaller form that is more common has the propodeum smooth or almost so (var. *meadiensis* nov.). Wings with well developed stigma and elongate cell sc; veins Rt1 and Rt3 curved, cell r3 above as long as or a little longer than r2, somewhat shorter below; vein Cut1 interstitial; Cu of fore wing reaching margin; Rt3 of hind wing far distant from base of R, its 1st abscissa well 3 times as long as Rt3 ; vein Cut of hind wing strongly curved at apex, joining Cu in a right or nearly right angle, distinctly prefurcal. Fore tarsi with 3 moderately long comb spines of the metatarsus which are shorter than the 2nd tarsal joint, the apical spine reaching the middle of the joint or slightly surpassing it; the 1st (basal) comb spine of the metatarsus varies in length, besides, in the var. *meadiensis* the comb spines are shorter on an average; lower comb spines are wanting. Pulvillus slender, not reaching middle of claws, with few comb bristles, claws distinctly dentate. The rows of spines on the under side of the terminal tarsal joint are very small, in var, *meadiensis* they are rudimentary or wanting.

Male: 5.5-8 mm. — Coloration as in the female, but the apical abdominal segments sometimes more or less darkened, in larger specimens the three first abdominal segments ferruginous, in others the 3rd and 4th dark only at base, in smaller specimens nearly wholly so; tergite VII ivory white, but mostly retracted.

Antennae comparatively slender and long, joint 3 about twice as long as 2 which is elongate. Thorax strongly convex, prothorax steeply declivous in front. Abdomen long and slender, as long as or somewhat longer than the thorax. Cu of fore wing reaching margin. Vein Cut of hind wing joining Cu in a pointed angle, prefurcal. Interior tooth of claws of fore legs directed forward, pointed or slightly truncate. Long calcar of hind tibiae longer than half of metatarsus.

Habitat: The species is common, especially in the desert valleys east of Cairo and Helwan. Localities: Kerdasa, Abu Rowash, Magadla, Borgash, Giza, Meadi, Helwan, Wadi Digla, Wadi Hof, Wadi Hussein ; Fayed, (iv-xi).

Pompilus seminiger Taschbg., Haupt

1880. *Pompilus seminiger* Taschenberg, *Zeitschr. f. Naturw.*, Halle, LIII, p. 774, female.
— *Sericopompilus seminiger* Haupt, Pompilidae Palästinas, MS. fig. 17).
nec. *Pompilus rhodosoma* Kohl (1886).

Description after Haupt:

Female, 8-9 mm. — Black; abdomen and legs (sometimes also part of coxae) red; tarsal joints sometimes more or less blackened, mostly only the ultimate joint blackened. The inner orbits may be more or less broadly yellow, the hind margin of the pronotum may be wholly or only laterally yellow. Lower frons and clypeus with grey pubescence. Wings more or less hyaline, apical third of fore wings mroe or less deeply infumated and with slightly paler extreme apex. Cell sc semilanceolate; cell r2 elongate trapezoidal, in front four-fifth as long as behind; r3 shortly trapezoidal, behind only two-thirds to three-fourths as long as r2, more or less strongly narrowed anteriorly, its exterior cross-vein more or less distinctly obtusely angled; Cut1 interstitial. Head rather flat, strongly narrowed behind eyes, the narrowing beginning already in the middle of the eye-convexity; temples very slightly convex, laterally linear. Ocelli forming a right angle, (pol): (ool) = 3:2. Frons with fine median sulcus; width of eye equalling half of frons. Antennae slender, joint 3 much longer than 1 and 2 combined. Clypeus transversely trapezoidal, rounded laterally, anterior margin straight or very slightly emarginated ; genae very short. Pronotum very short, posterior emargination slight with indication of an obtuse angle at middle. Postnotum as long as the postscutellum. Propodeum slightly convex, with fine white pilosity, at the sides with some very fine rugae (indistinctly transversely aciculated). Fore legs with moderately long tarsal comb, metatarsus with 3 comb spines, the ultimate spine longer than the 2nd tarsal joint; as far as can be judged from the mutilated specimens joints 2 and 3 of the fore tarsi have only one (apical) spine.

Male: 7 mm. (hitherto unknown). — Similar to the female in coloration, but the coxae sometimes more or less reddened. Wings very similar to those of the female. Head as in the female; position of ocelli slightly obtusely angled, (pol) : (ool) nearly = 4:3. Antennae also rather long, joint 3 subequal to 1 and 2 combined. Postnotum somewhat longer than the postscutellum. Genital plate dark brown to black, shallowly sulcate, broadly rounded apically, little visible.

Distribution: Abessinia, Cyrenaica, Palestine.

Haupt saw Taschenberg's type from Abessinia, males from Cyrenaica, but his Egyptian record obviously refers to *rhodosoma* Kohl which is definitely another species, since I have seen Kohl's type (holotype) which is identical with the species described herein under Kohl's name.

I should have identified Haupt's *seminiger* with our common species *P. arenicola,* but in the latter species of which I examined numerous specimens the comb spines of the fore tarsi are distinctly shorter than the 2nd tarsal joint, and the prothorax is never margined with yellow posteriorly, the orbits are not yellow, as there is only sometimes (not mostly) a ferruginous dot noticeable at the inner orbits. *P. seminiger* seems to be closer to *gentilis* Klug the only species known to me in which the orbits and the prothorax are lined with yellow, but also in this species the comb spines are not longer than the 2nd tarsal joint.

Pompilus elbanus spec. nov.

Female: 6.5-7 mm. — Rather similar to *P. rhodosoma* Kohl, but differing by the longer antennae, the shorter comb spines of the fore tarsi and the only slightly curved transverse anal vein (Cut) of the hind wing.

Black, abdomen ferruginous, segment I slightly blackened at base; antennae and legs black, tibiae dull reddish and also the tarsi sometimes so. Pubescence grey, as in *rhodosoma,* and also the infumation of the wings as in this species.

Eyes broader than half of frons, orbits parallel at base, slightly converging in upper half, only very slightly emarginated. Clypeus a little emarginated anteriorly. Temples, in lateral aspect, of about one-third of the eye's width, set with raised white hairs. Position of ocelli rectangular; (pol) somewhat longer than (ool). Frons with longitudinal sulcus. Genae very short. Antennae and legs slender, joint 3 of the former longer than 1 and 2 united. Prothorax short, declivous in front, hind margin forming an arc. Scutellum slightly convex. Postnotum longer than postscutellum, with deep median longitudinal sulcus. Propodeum *slightly* convex, only posteriorly and laterally with transverse wrinkles, in small specimens only indistinctly so. Stigma brown; 1st and 3rd cell r curved, 2nd longer than 3rd; Cu of fore wing reaching margin; vein Cut1 distinctly postfurcal; transverse anal vein (Cut) of hind wing joining Cu in a pointed angle, rather flatly curved, prefurcal. Anterior metatarsus with three moderately long comb spines the apical of which reaches about the middle of the 2nd tarsal joint: inferior comb spines wanting. The long calcar of the hind tibiae half to more than half as long as the metatarsus, spines of hind tibiae weaker than in *P. rhodosoma.* Apical joint of middle and hind tarsi beneath without rows of small spines. Pulvillus small, only about one-third as long as the claws, the latter dentate.

Habitat: 2 females, Gebel Elba, Wadi Aideb, 2.ii.1938, leg. H. Priesner.

Pompilus khargensis spec. nov.

Female: 8.5 mm. — Body, legs and antennae black; mandibles reddish in the middle. Head in front, coxae, temples, propodeum with silvery-grey pubescence, besides, tergites I and II with narrow grey apical band and with traces of such a one also on tergite III. Wings only very slightly infumated, with broad, dark *subapical* band, so that the extreme apex remains hyaline.

Eyes indistinctly emarginated within, orbits slightly converging towards base and apex; one eye about as broad as half of frons. Temples, laterally, short, scarcely half as thick as the eye, and very short in dorsal aspect. Clypeus strongly transverse, at anterior margin straight and very narrowly smooth and shining. A fine frontal sulcus indicated only above antennal cavities. Position of ocelli nearly rectangular, (pol) distinctly longer than (ool). Temples below with erect whitish hairs. Antennae slender, joint 3 a little longer than 1 and 2 combined. Prothorax scarcely convex, in lateral aspect, dorsally nearly parallel-sided, hind margin emarginated in a very flat angle. Scutellum and postscutellum not high. Postnotum at least as long as the postscutellum, with fine longitudinal sulcus. Propodeum little convex, with distinct median sulcus, surface with conspicuous, but very fine, transverse striation. First abdominal segment little convex, apex of abdomen with few bristles, last tergite with fine brown pubescence. Wings narrow; vein Cut1 distinctly postfurcal; pterostigma small, dark; cell sc short; cell r2 nearly triangular, so that the 2nd abscissa on R is somewhat shorter than the short 1st abscissa, 3rd abscissa almost as long as 4th; *cell r3 rectangular,* with vein Rt3 somewhat curved; Rt1 little curved, Rt2 oblique; 2nd recurrent vein (Mt2) interstitial with Rt3; the longitudinal veins of the fore wing are ending far distant from wing margin; transverse anal vein (Cut) of hind wing very flat, prefurcal. Fore tarsi with three black comb spines, the last of them distinctly surpassing apex of 2nd tarsal joint. Longer calcar of hind tibiae at most as long as half of the metatarsus; under side of the ultimate tarsal joint with a double row of fine spines. Pulvillus moderately large, triangular, comb hairs scarce, tooth of claws moderately large, vertical.

Habitat: 1 female, Oasis Kharga, 14.iii.1934, leg. H. Priesner.

Subgenus Ageniopompilus nov.

Pompilus spiniprivus spec. nov.

(Fig. 8)

Female: 6.6-7 mm. — Black, clypeus at fore margin and mandibles in the middle reddish. Abdomen wholly red, only tergite I with a black spot at base. Legs dusky red, coxae black. Wings slightly infumated, with its dark margin not reaching cells, only half filling cell sc. Body sparingly covered with grey pruinose pubescence.

The eye as broad as half of frons, orbits scarcely emarginated, frontal line fine but complete. Temples, in lateral aspect, very narrow, about one-third of width of eye. Clypeus straight in front. Genae present, but short. Antenae slender, joint 3 longer than 1+2, joint 4 as long as 1+2. Body without noticeable raised hairs. Prothorax, from the side, strongly convex, nearly parallel-sided in dorsal aspect, with slighty median line, hind margin arched. Postscutellum almost vertical behind, postnotum almost as long as the postscutellum, distinctly transversely striate, with fine sulcus. Propodeum without longitudinal sulcus, slightly impressed behind, with conspicuous but irregular transverse wrinkles, especially at the sides but also in the middle; distinctly convex, in lateral view. End of abdomen without prominent setae. Basal vein strongly curved, vertical upon Cu; nervulus interstitial (or slightly prefurcal), vertical; Cu of fore wing nearly fully reaching apex; pterostigma only moderately large; vein Rt1 strongly curved, cell r2 about as high as long, *r3 higher than long*, narrowed towards fore margin, above half or more than half as long as below, where it is mostly somewhat shorter than r2; cell m3 scarcely pointed below. Basal portion of R of hind wing almost twice as long as Rt3; vein Cut somewhat curved, joining Cu in an acute angle, strongly prefurcal; apical section of Cu of hind wing nearly evenly curved. Anterior metatarsus very slender, without conspicuous comb spines, the three minute spines present are much shorter than the apical width of the metatarsus; the 1st of these three vestigial spines is much farther distant from the two distal ones than these from each other. The longer calcar of the hind tibiae is a little more than one-third as long as the very slender metatarsus; hind tarsi beneath without a row of spines. Pulvillus slender, not quite half as long as the long claws, the latter unarmed.

Male unknown.

Habitat: 2 females, Meadi, 14.ix.1931, leg. H. Priesner.

Pompilus fasciatellus spec. nov.

Female: 4.8-6.5 mm. — Head ferruginous, with large black spot on the frons, leaving only the orbits pale; prothorax, scutum, scutellum and postscutellum brownish red, propodeum and abdomen black. Legs dusky testaceous, the extreme tips of the middle and hind tibiae indistinctly darker, meso- and metasternum dark, coxae reddish brown, darker above; femora slightly infuscated *within;* the apices of the middle and hind tarsal joints and the 5th joint blackened. Antennae testaceous, slightly darkened at apex. *Wings hyaline, with two transverse dark bands,* viz. a complete parallel-sided one along the basal vein, and a 2nd shortened one filling half of cell sc, apex of cell r1 and the whole cells r2 and r3, with the exception of the basal inner angle of cell r2, which remains hyaline. Propodeum with rather long silvery, abdomen with brownish adpressed, pubescence.

The eye is about as broad as one-half of frons, the orbits are parallel-sided below, then emarginated so that they converge towards the vertex. Genae very short. Clypeus somewhat emarginated in front. Temples very short, laterally only one-third as wide as the eye. Antennae long and slender, joint 2 elongate, 3 longer than 1 and 2 combined. Prothorax short, in lateral view convex, in dorsal aspect slightly rounded and narrowed towards apex, hind margin strongly, almost angularly, excavated. Notauli fine. Postnotum more than half as long as postscutellum, shining, only very finely transversely striate. Propodeum evenly convex, densely clothed with wavy silvery white pubescence, narrowed posteriorly, in dorsal aspect. 1st abdominal segment only slightly convex. Vein Cut1 interstitial, somewhat oblique; lower part of basal vein slightly curved, but not quite vertical; vein Rt1 curved, *veins Rt2 and Rt3 straight,* both in opposite direction oblique; 2nd abscissa of R three to four times as long as 1st, and not quite twice as long as 3rd; cell r2 long, above and below much longer than r3; M does not quite reach the margin, but Cu does; cell m3 pointed below; vein Cut of hind wing strongly prefurcal, forming a pointed angle with Cu; terminal portion of Cu of hind wing curved, but more strongly so in distal third; hind tibiae with a few pale spines only; the longer calcar of the hind tibiae not quite half as long as the metatarsus. Pulvillus moderately large, claws with conspicuous vertical tooth. Fore tarsi *without* conspicuous comb spines (there are three extremely short spines present), the terminal spines of the metatarsus is distinctly shorter than the apical width of the metatarsus. Apical joint of hind tarsi bare, without inferior rows of spines.

Habitat: 1 female, Kerdassa, 16.vi.1929, leg. H. Priesner; 1 female, Esbeth El-Nakhl, 31.v.1935, leg. Alfieri.

A very remarkable species, by the coloration of body and wings, the rudimentary comb spines of the fore tarsi; at first sight it reminds of the genus *Pseudagenia.*

Although near *Sericopompilus,* the last two species are characterized by the absence of a tarsal comb, by having a short cell r3 in the fore wing, and also by their affinities to *Pseudagenia,* i.e. comparative weak leg spines, nearly evenly curved apical part of Cu of hind wing, not very distinctly pointed cell m3 of the fore wing. They cannot be referred, however, to the *Macromerinae,* because of the distinctly splayed out, though short, spines at the apex of the tibiae, the lack of a sharp transverse furrow on the 2nd sternite of the abdomen, and the non-petiolate 1st abdominal segment.

Subgenus Ridestus Banks

Pompilus melas Klug

1834. *Pompilus melas* Klug, Symb. phys., pl. 39, fig. 3 (female).
1929. *Pompilus melas* Haupt, *Mitt. zool. Mus. Berlin,* XV, p. 126.

Female: 18-24 mm. — Black, anterior body often dark reddish (especially so in old rubbed specimens caught in autumn), orbits narrowly reddened. Wings *yellow,* their apical margin sharply defined blackened, hind wings only in basal half of hind margin dark, apical half and the whole apex mostly yellow.

Orbits almost wholly parallel-sided, very slightly converging towards vertex, with quite indistinct upper emargination. The eye somewhat narrower than half of frons. Genae short. Clypeus normal. Antennal joint 3 very long, much longer than 1+2. Prothorax strongly convex, steeply declivous in front, broadly and deeply emarginated posteriorly. Scutellum convex lengthwise. Postscutellum much protruding over the postnotum, the latter about half as long as the former, transversely striate, with median impression. Propodeum strongly convex, with deep and full median sulcus, not very strongly transversely striate, the wrinkles, in front, somewhat oblique from the middle to the sides. Veins Rt1 and Rt3 curved, the former strongly oblique, Rt2 straight, somewhat oblique; cell r2 above more than twice, below more than 1.5 times, as long as cell r3; basal vein straight; Cut1 interstitial. The apically hooked vein Cut of the hind wing interstitial. Fore tarsi with 4 long, and mostly 1 short, lateral comb spines of the metatarsus, inferior comb spines (3) extremely short. Comb bristles of the small pulvillar plate somewhat surpassing the latter. The longer calcar of the hind tibiae is more than one-third as long as the metatarsus. Under side of the apical joint of the tarsi with conspicuous double rows of small spines, also in the male. Claws strongly dentate (11).

Male: 8.5-14 mm. — Coloration as in the female, but the hind wings always broadly blackened on the whole posterior margin. Antennal joint 3 little longer than 1 and 2 united, about 3.5 times as long as 2. Propodeum not transversely wrinkled. Interior claw of fore tarsus slightly S-shaped at apex, with large, often truncate basal tooth. Claws distinctly dentate. Genital plate compressed, in both aspects slender, without long raised hairs.

Habitat: The insect is fairly common, from v.-xi., in the Delta, the Nile valley, the Libyan and Arabian desert and in the Sinai. Localities: Siuf, Bilbeis, Gabal Asfar, Abu Rowash, Kerdasa, Pyramids, Cairo, Meadi,

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(11) *Pompilus kruegeri* Haupt (*Boll. Lab. Ent. Bologna,* vi, 1933, p. 62) from Cyrenaica, not yet found in Egypt, differs, according to Haupt, from black specimens of *melas* by the particularly broad abdomen, in which the 2nd segment is nearly twice as broad as the scutum at fore margin.

Helouan, Sakkara, Wadi Digla, Wadi Umm Assaad, Suez Road; Sinai (Umm Mitla, Kosseima, Wadi Gederât, El-Areesh).

Distribution: Egypt, Hedjas, Yemen.

Pompilus rutilus Klug

1843. *Pompilus rutilus* Klug, Symb. phys., pl. 38, fig. 4 (female).
1933. *Pompilus rutilus* Haupt, *Boll. Lab. Ent. Ist. Agrar. Bologna*, VI, p. 61.

Female: 11.5-18 mm. — An easily definable species, by the size, the coloration and the strongly excavated clypeus.

Ferruginous; postscutellum, propodeum and, for the major part, the under side of the body, black. Coxae chiefly dark. Antennae ferruginous, darkened towards apex.

Clypeus in front strongly emarginated. Frons below much broader than above, eyes slightly emarginated. Temples, in lateral aspect, thick, more than half as broad as the eye. Frons with sulcus. Position of ocelli rectangular, (pol) much longer than (ool). Antennal joint 3 somewhat longer than 1 and 2 combined. Prothorax convex, with median sulcus and posteromarginal depression. Post-scutellum and propodeum with median sulcus. Postnotum short, medianly not half as long as the postscutellum. Propodeum everywhere strongly transversely wrinkled. Wings shaded, besides, with apical darkening, hind wings paler at base. Cell r3 rather long above, but shorter than r2; 1st abscissa of R very short; Cu of fore wing not reaching margin; Cut1 oblique, interstitial. Transverse anal vein (Cut) of hind wing strongly curved, hook-like, slightly prefurcal. 1st metatarsus with four comb spines the last of which being shorter than the 2nd tarsal joint. Terminal tarsal joint with a double row of spines of the under side that are wanting in the male. Pulvillus small.

Male: 7-12 mm. — Very similar to the female, clypeus emarginated, too. 1st and 2nd antennal joint ferruginous. Propodeum not transversely striate, with fine silky pubescence.

Habitat: Rather common in Middle and Upper Egypt. Localities: Mansuria, Abu Rowash, Borgash, Kafr Hakeem, Kerdasa, Gebel Asfar, Marg, Cairo, Meadi, Helouan, Giza, Fayoum, Oases Kharga and Dakhla. We have no records from the desert valleys.

Pompilus ruficeps Ev. aegyptiacus nov.

Female: 10-15 mm. — Head, prothorax, scutum and scutellum, often also antennal joint 1 (to 3) and more or less the fore legs dull ferruginous, the middle and hind legs sometimes brown-red, the rest of the body black. Wings infumated, with indistinct metallic lustre. Abdomen finely pruinose pubescent, brownish, but in certain directions with violet sheen.

Head with short, raised brownish pilosity. The eye as broad or scarcely broader than half of frons. The latter below distinctly broader than above. Eyes scarcely emarginated. Clypeus truncate in front, with narrow smooth anterior margin. Ocelli forming a right angle (pol) = (ool). Temples, in lateral aspect, somewhat narrower then the eye. Genae very short, clypeus practically touching eyes. Antennae slender, joint 3 distinctly, 4 little longer than 1+2. Prothorax slightly rounded and narrowed towards apex, with noticeable median sulcus and indistinct depression of hind margin, disk with slight calli, hind margin obtusely angled. Scutellum and postscutellum convex. Postnotum somewhat shorter than the postscutellum, tranversely striate. Propodeum with conspicuous transverse wrinkles, the striae not curved backward, at the sides (as this is the case in *P. cliens* Kohl). Apical tergite with a few fine dorsal bristles and some longer lateral ones. Cell sc and cells r subequal in hight. Veins Rt1 and Rt3 curved, Rt2 straight, cell r3 below about as long as 2, above somewhat shorter; stigma normal; Cut1 oblique, slightly postfurcal; Cu of fore wing ending far from apex of wing. Vein Cut of hind wing nearly interstitial (slightly prefurcal), vertical, i.e. joining Cu in an almost right angle. Fore tarsi with 4 fine comb spines of the metatarsus the last of which is about as long as the 2nd tarsal joint; in front of the 4 comb spines there is sometimes a short proximal one; inferior comb spines wanting. Terminal tarsal joint with a double row of small spines. Claws distinctly dentate, pulvillus very slender, with few comb bristles. Longer spur of hind tibiae somewhat shorter than, or scarcely as long as, half of the metatarsus.

Male: According to Haupt, the male of the typical *ruficeps* Ev. is similarly coloured, and the genital plate is reddish, tapering towards apex and highly and sharply keeled. Third antennal joint three times as long as 2nd joint. Length: 8-12 mm.

Habitat: The species is distributed over the northern coastal area, in the collection of the Ministry of Agriculture there are specimens from Abukeer, Mamura, Mex, Dekheila, Amriah and Borg El-Arab. It is rare in Middle Egypt (Magadla, Suez Road, Fayoum).

In the collection of the Ibrahim University, there is a small (8.5 mm.) specimen (female) from Kom Osheem (Fayoum), 4.iv.53, in which the last comb spine of the metatarsus is somewhat longer than the 2nd tarsal joint. The species seems to be somewhat varying in the length of the spines.

On comparing the Egyptian specimens of *ruficeps* with those from Southern Europe (Isle of Krk, Yougoslavia), I noticed that the temples are more strongly narrowed, showing a flatter arc, in dorsal aspect, and that they are narrower as compared with the eyes, in lateral aspect, in the Egyptian specimens. The comb spines are somewhat longer in the former than in the latter. These differences may be racial, thus the Egyptian form may be called ssp. *aegyptiacus*.

Pompilus sinaiticus spec. nov.

Female: 10.5 mm. — Head, prothorax, mesonotum and scutellum, except its apex, pale ferruginous, head right behind ocelli with a dark, arched, transverse spot; clypeus dark with pale fore margin; fore legs dusky red, middle and hind legs blackish red; antennae reddish beneath; sterna, propodeum, coxae and abdomen black, the latter with dark grey pruinose pubescence, and therefore appearing to be paler than in *P. ruficeps*. Wings distinctly infumated with hardly marked darker apical margin.

The eye is distinctly somewhat broader than half of frons, the orbits are parallel below, convergent above. Clypeus nearly straight in front. Ocelli forming a right angle (pol) little longer than (ool). Median line of frons feeble. Temples, in lateral aspect, less than half as wide as the eye. Genae short. Antennae very slender, joint 3 much longer than 1 and 2 combined. Prothorax with calli and median sulcus, but marginal depression indistinct; in lateral view the pronotum is little convex, the hind margin is only slightly (angularly) emarginated. Postnotum as long as postscutellum, with rather broad median sulcus. Propodeum with feeble sulcus anteriorly, otherwise with weak and uneven transverse wrinkles. End of abdomen with a few weak bristles only. Cell r3 above less than two-thirds of r2, below about two-thirds of it, in front (above) more than half as long as behind; veins Rt1 and Rt3 curved, Rt2 straight, vertical, vein Mt3 ending in the middle of r3; Cu ending far from apex of wing; Cut1 interstitial, little oblique. Vein Cut of hind wing about interstitial. Longer calcar of hind tibiae not quite half as long as the metatarsus; anterior metatarsus with four comb spines, the last of which is shorter than the 2nd tarsal joint. Terminal joint of tarsi with a double row of minute spines; pulvillus slender, comb bristles little surpassing it. Claws dentate, tooth in the middle.

Habitat: 1 female, Sinai, Wadi Gharandel, 18.v.1934, leg. H. Priesner.

This species, easily distinguished from *ruficeps*, has to be compared with *P. semifuscus* Haupt. from Palestine. In the latter species, however, the ocelli are placed in an obtuse angle, the temples are strongly convex, laterally almost as thick as the eye, and, in anterior aspect, the eye is about three-fourths as wide as one-half of the frons.

Pompilus modestus Klug

1834. *Pompilus modestus* Klug, Symb. phys., pl. 38, fig. 5. Female.
1941. *Pompilus modestus* Guiglia, *Ann. Mus. Stor. Nat. Genova,* LXI, p. 164.

Description by Klug:

Testaceous, thorax and abdomen black, wings hyaline, blackish at apex. Ferruginous, with silvery pruinose pubescence. Head not spotted, antennae darker at apex. Thorax elongate, without dorsal markings, black in the middle below, propodeum with tubercles on both sides, silvery. Legs testaceous. Wings hyaline, broadly darkened at apex, veins and pterostigma dark brown. Tegulae testáceous. Abdomen black, with silvery pruinose pubescence. Length 10-11 mm. (cf. illustration). Patria : Sudan (Ambukohl).

The species is recorded by Guiglia from Libya (identified by Haupt), and may occur in Egypt, though it has so far not been found in this country.

Pompilus masrensis spec. nov.

Female: 8-9 mm. — Head, prothorax, scutum and scutellum dull ferruginous; of the same coloration are antennal joints 1 and 2, and the following joints beneath, the fore legs (inclusive of coxae), the epipleurae (with black spot) and the base of the middle coxae; propodeum, middle and hind legs and coxae black, sometimes the middle and hind femora dark ferruginous; head with jagged black transverse spot in front of ocelli. Dark specimens have the cephalic spot larger and more or less extending to base of antennae, and the scutellum and also the fore legs more or less darkened. Fore wings hyaline about the basal half, gradually darkened towards apex, with or without distinctly darker apical margin, which may be somewhat paler again at extreme margin.

Orbits narrowed towards vertex, eyes only slightly emarginated, the *frons being below much broader than above between the ocelli.* Clypeus broad, rounded in front, touching the eyes laterally. Genae scarcely visible. Distance of hind ocelli as compared to that between eye and hind ocelli = 4:3. Temples, in lateral aspect, scarcely half as broad as the eye. The whole body finely pruinosely pubescent, but the ground is not covered. Antennae and legs very slender, joint 3 very long, much longer than 1 and 2 combined, joint 4 somewhat longer than 1+2. Prothorax broadly emarginated behind, with median sulcus and very slightly depressed hind margin. Postnotum well developed, but shorter than the postscutellum. Propodeum long, parallel-sided almost beyond middle, dull, distinctly and finely transversely striate, not flattened posteriorly, and evenly convex, in lateral aspect. Apical tergite with a few weak bristles at the sides. Cell r3 above not or little shorter than r2, below distinctly shorter, veins Rt1 and Rt3 strongly curved, Rt2 straight, vertical; Cut1 interstitial; Cu not reaching apical margin. Vein Cut of hind wing semicircularly curved at apex, slightly prefurcal; basal portion of R of hind wing 2.5 times as long as Rt3. Metatarsus of fore legs with three moderately long comb spines that are not widened towards tip, the terminal comb spines somewhat surpassing the middle of the 2nd tarsal joint; inferior comb spines wanting. Under side of tarsi with extremely fine spines. Claws dentate, pulvillus slender, comb bristles few, fine.

Male unknown.

Habitat: Kerdasa, Wadi El-Tih, Wadi Hof, Wadi Rashrash, Wadi Assiouti, Fayed, from iii. to x. (coll. Min. Agric., Alfieri and Priesner).

This species cannot be identical with *P. modestus* Klug, unknown to me, since the propodeum is red in the latter species and the apical darkening of wings is much more sharply defined.

Subgenus Arachnospila Kincaid

Pompilus anubis Haupt

1933. *Pompilus anubis* Haupt, *Boll. Lab. Ent. Ist. Agr. Bologna,* VI, p. 71, fig. XIV.

Female: 15 mm. — Black, with black pubescence and black pilosity; pubescence with brown sheen in certain directions. The outer orbits with a short brown line above. Wings smoky brown, with darker apical margin, cells r2 and r3 subequal at base, r2 only little narrowed anteriorly, and here scarcely one-third as long as at base; veins Rt1 and Rt3 only slightly curved. Vein Cut of hind wing joining Cu in a strong curve, somewhat prefurcal.

Head conspicuously produced behind eyes, temples strongly convex, broader than the eye, in lateral aspect. Ocelli forming an obtuse angle (pol):(ool) = 2:3. Median line of frons scarcely indicated, orbits, as a whole, parallel, the eye three-fourths as broad as half of frons. Antennal joint 3 as long as 1+2. Clypeus trapezoidal, straight in front. Genae anteriorly nearly as long as the width of an antennal joint, strongly widened posteriorly. Shoulders of the pronotum broadly rounded but not distinctly raised, hind margin depressed, obtusely excavated. Notauli only posteriorly indicated; postnotum half as long as the postscutellum, distinctly transversely striate. Propodeum strongly convex, rather short, without visible sculpture, with the indication of a sulcus anteriorly. Abdomen beneath and at apex sparingly pilose, otherwise bare, the declivity of the 1st tergite lies parallel to its lateral hind margins. Fore legs with comb of tarsi, metatarsus with three short comb spines which are about half as long as the 2nd joint. Longer calcar of hind tibiae somewhat longer than half of metatarsus.

Male unknown.

Habitat: Egypt (without locality).

The above description is a translation of that given by Haupt (l.c.). The species remained unknown to me.

Pompilus fallaciosus spec. nov.

Female: 11.5-15 mm. — Black, inner orbits narrowly margined with red, in one specimen frons wholly black. Head, prothorax and propodeum, as well as abdominal tergite I laterally at base with comparatively short and fine, little dense black pilosity that is easily rubbed off. Wings dark, without or with very indistinct blue lustre that is not so strong as in *P. mimus*.

Frons above not narrower than below, eyes hardly emarginated. The eye somewhat narrower than half of frons. Ocelli forming an obtuse angle, (pol) somewhat shorter than (ool). Genae short. Clypeus almost but not fully touching the eyes, not or scarcely emarginated in front, with narrowly smooth margin. Temples, in lateral aspect, widened below, more than half as broad as the eye, at the vertex about half as broad. Antennal joint 3 longer than 1 and 2 combined, distance of eyes on the vertex scarcely longer than antennal joint 2 and 3 united. Prothorax slightly narrowed towards apex, broadly emarginated behind, without postero-marginal depression and without median sulcus. Scutellum (laterally) slightly convex, somewhat higher than the postscutellum, postnotum short, scarcely half as long as the postscutellum, without median sulcus. Propodeum, in lateral aspect, convex anteriorly, with strong median sulcus, declivity slightly impressed, but sides scarcely callous posteriorly. The pruinose pubescence of the abdomen has a violet-brown sheen. Last tergite with a few fine raised bristles. Vein Cut1 of fore wing *oblique,* interstitial. Pterostigma hardly one-third as long as fore margin of cell sc, the latter large, higher than the cells r; veins Rt1 and Rt3 curved, 2nd abscissa of R 1.5 times as long as 1st or 3rd; cell r3 above one-third to one-half as long as below; Cu ending far from apical margin. Vein Cut of hind wing ending vertically, interstitial or slightly postfurcal. Anterior metatarsus with four comb spines, of which the basal one is mostly shorter than the others, the terminal spine always surpasses the middle of the 2nd tarsal joint and reaches sometimes its apex; there are three very short *inferior* comb spines present. Ultimate tarsal joint without spines on the under side. Claws dentate, pulvillus large, in perfect specimens with 16 densely posited comb bristles. Calcar of hind tibiae at most half as long as the metatarsus.

Habitat: Wadi Hussein, v. (leg. Priesner); Wadi Gederât (Sinai), v. (coll. Min. Agric.).

Differing from *P. anubis* in having 4 longer comb spines of the anterior matatarsus and in that the head is narrower across the temples than across the eyes. The new species is probably more similar to *P. dubitabilis* Saund. (Algeria) (cf. Saunders, *Trans. Ent. Soc. London,* IV, 1901, p. 551), but in our species cell r3 is above not nearly closed as in *dubitabilis,* the fore margin of the clypeus is not narrowly raised and the distance between the hind ocelli is somewhat shorter than that between eyes and ocelli, while these measurements are equal in *dubitabilis.*

Pompilus mimus spec. nov.

(Fig. 9)

Female: 13-17 mm. — Black, orbits never paler, antennae and legs black. Pubescence of the abdomen with a brownish violet sheen in certain directions, the wings dark, *with a distinct violet lustre.* Head, thorax and base of the 1st tergite with raised black pilosity, that is shorter than in *P. calidus,* and scarcer. Body dull.

Head, in frontal aspect, broader than long, *the eye broader than half of frons.* Orbits emarginated in a flat arc, frons little broader below than above. Temples very short. Mandibles above, and clypeus at the sides, practically touching the eyes. Clypeus in front very slightly emarginated. Temples, in lateral aspect, very short, even below *only one-third as thick as the eye.* Ocelli forming a slightly acute angle, (pol) as long as or slightly longer than (ool). Distance of eyes on vertex shorter than antennal joint 3; the latter slender, much longer than 1 and 2 combined, even joint 4 somewhat longer than this combination. Prothorax convex, without median sulcus and without depression of the hind margin, broadly and flatly emarginated behind. Scutellum flattened, postnotum half as long as the postscutellum, with median sulcus. Propodeum dull, not transversely striate, evenly convex, with sharp median sulcus. Vein Cut1 oblique, straight, interstitial; pterostigma moderately large; vein Rt1 slightly, Rt3 strongly curved, cell r3 below about as long or little longer than r2; 1st and 3rd abscissa of R half as long as 2nd. Vein Cut of hind wing vertical at apex, interstitial or distinctly postfurcal. Cu of fore wing not reaching margin. Metatarsus of fore legs with 4-5 comb spines, and usually one long inferior one; comb spines fine, the apical one of the metatarsus somewhat surpassing the apex of the 2nd tarsal joint; pulvillus large, broad, with numerous densely set stout comb bristles that surpass the former; ultimate joint of tarsi bare on under side. Longer calcar of hind tibiae scarcely half as long as the metatarsus.

Male unknown.

Habitat: Wadi El-Tih, x. (leg. Rabinovitch, coll. Alfieri), Wadi Hof, x. (leg. H. Priesner); Sinai (iii) (coll. Min. Agric.).

This species is closely allied to *P. fallaciosus,* but is at once distinguished by the short temples and the violet wings; from *calidus* it differs by the short genae, the shorter pilosity and the non-striate propodeum; from *dubitabilis* by the more widely open cell r3, the equally long comb spines, and the longer antennal joint 2+3, as compared with the distance of the eyes on the vertex.

Pompilus mareoticus spec. nov.

(Fig. 10)

Female: 8.5-9 mm. — Body (inclusive of orbits) black, mandibles reddish distally. Wings strongly smoky, without blue lustre, apical margin scarcely darker. Pubescence of body brownish, pruinose, *body shining;* head, prothorax and propodeum (posteriorly) with short, little dense, raised black pilosity. Frons with feeble median line, the eye distinctly narrower than half of frons. Clypeus very strongly transverse, nearly touching the eyes laterally, truncate at fore margin. Genae developed but short, exteriorly about as long as antennal joint 2. Ocelli forming a right angle, (pol) : (ool) = 3:4. Temples, in lateral view, above hardly one-third, below about one-half, as thick as the eye. Antennae moderarely long, joint 3 only as long as 1, joint 2 as long as wide, convex interiorly; 1st antennal joint pilose exteriorly. Pronotum angularly excavated at hind margin, with feeble median sulcus and slight marginal depression. Scutellum convex. Postnotum scarcely half as long as postscutellum, somewhat narrowed in the middle, apparently somewhat depressed transversely, without sulcus. Propodeum short, strongly convex, somewhat flattened behind, with rather broadly separated hind margin. Fore wing with vein Rt1 *angularly broken,* Rt2 slightly curved in its lower third, Rt3 strongly curved; cell r3 above nearly as long as r2, *below not twice as long as above;* pterostigma well developed, somewhat longer at fore margin than cell sc at fore margin, the latter comparatively short; Cut1 interstitial; Cu ending far from apical margin; vein Cut of hind wing forming a flat arc so that the angle with Cu is still a pointed one, interstitial or slightly prefurcal. Metatarsus of fore legs with *four* comb spines, the 1st one being half as long as the others and pointed, the three distal spines are slightly widened, about as in *Dicyrtomellus claviger,* the ultimate one longer than the 2nd tarsal joint and reaching about the middle of the 3rd joint; inferior comb spines apparently wanting. Longer calcar of hind tibiae slightly more than half as long as the metatarsus. Pulvillus conspicuous, comb bristles few, not or scarcely surpassing the pulvillus. Claws distinctly dentate.

Habitat: I only know 1 female from Abuseer (Mariout), 12.vi.1936, leg. A. Rabinovitch (coll. Alfieri).

Pompilus kochi spec. nov.

Female: 8.5 mm. — Body black, with brown, on the abdomen more ferruginous pruinose pubescence, without any longer pilosity. Legs and antennae black, mandibles red at middle. Wings distinctly shaded, fore wings with darker margin, so that cell sc, the exterior cells r and m are limited exteriorly by a narrow paler line. The smaller spines on the legs are brownish-yellow, *the comb spines testaceous.* Frons and clypeus with brownish grey pubescence.

Eyes slightly emarginated within, one eye somewhat narrower than half of frons, the latter with fine median sulcus. Clypeus touching the eyes laterally, straight at fore margin. Temples, in lateral aspect, more than one-half as thick as the eye. Ocelli forming an obtuse angle, (pol) = (ool), or the former a little longer. Head, from above, narrower across the convex temples than across the eyes. Antennal joint 3 curved, somewhat longer than 1+2. Prothorax, in lateral aspect, rather convex, anterior area flattened and declivous, not pubescent; in dorsal aspect the prothorax is nearly parallel-sided, without median sulcus, hind margin very slightly arched, not angular. Scutellum little convex, postnotum *scarcely visible* at middle. Propodeum rather steeply declivous posteriorly, flattened, in front with *short* longitudinal sulcus, at the hind angles with a few pale hairs. Abdominal tergite 1 steeply declivous in front, terminal segments with a few fine hairs. Vein Cut1 of fore wing somewhat oblique, interstitial. Wings with dark, moderately large pterostigma; veins Rt1 and Rt3 curved, Rt3 nearly broken, Rt2 not quite vertical, slightly curved; cell r2 below somewhat longer than r3, the latter very short above, *nearly closed,* so that the 3rd abscissa on R is at most one-third as long as the 2nd, the latter being not quite twice as long as the 1st; Cu of fore wing by far not reaching margin; Cut of hind wing strongly curved at apex, ending vertically on Cu, somewhat postfurcal. Anterior metatarsus with *five* fine long testaceous comb spines, the last of which reaching wholly or nearly the apex of the 3rd tarsal joint; besides, there are on the metatarsus 2 moderately long lower comb spines, on the under side. Longer calcar of the hind tibiae not quite as long as half of metatarsus; hind tarsi on under side bare, without rows of spines. Claws with conspicuous median vertical tooth, pulvillus well developed, longish, comb bristles stout, distinctly surpassing the pulvillus.

Habitat: 1 female, taken by me in the Wadi El-Tih in June. I have named this species after my friend Mr. C. Koch (Pretoria) who much contributed to the knowledge of the insects of this country.

Pompilus calidellus spec. nov.

Female: 7.5-8.5 mm. — Black, the abdominal segments, especially at their hind margins, indistinctly dull reddish transparent. Legs and antennae black, wings strongly infumated with somewhat darker apical margin, hind wings a little paler. Wings without blue lustre.

Head, thorax and abdominal tergite I at base, as well as the legs with long raised pilosity, that is particularly conspicuous on the fore coxae and the under side of the head. Dull, abdomen slightly shining. Eyes interiorly above very slightly emarginated, little narrower than half of frons: the latter above scarcely narrower than below. Genae moderately long, but well developed, longer than in *mimus* and *fallaciosus,* but shorter than in *calidus.* Mandibles and clypeus not touching eyes. Clypeus truncate in front. Temples, in lateral aspect, about half as thick as the eye. Antennal joint 3 about as long as 1+2, joint 4 as long as 1. Horizontal portion of the prothorax very short, moderately deeply emarginated behind. Scutellum, in lateral aspect, flat, postscutellum almost on the same level. Postnotum about half as long as the postscutellum. Propodeum short, declivity longer than horizontal portion, median sulcus feeble, declivous part with *very fine* transverse striation, slightly shining, feebly impressed or only flattened; propodeum with long raised black pilosity. Pterostigma well developed, more than half as long as cell sc at fore margin; 1st abscissa of R one-third to one-half of 2nd; cell r3 above one-half (or less) as long as below; vein Cut1 somewhat oblique, curved, interstitial or slightly postfurcal; Cu of fore wing not quite reaching margin. Vein Cut of hind wing joining Cu in a right angle, slightly prefurcal. Fore tarsi moderately long, anterior metatarsus with *three* black comb spines the last of which surpasses the middle of the 2nd tarsal joint, but does by far not reach its apex; inferior comb spines wanting; 5th tarsal joint without rows of spines on the under side. Claws dentate. Pulvillus moderately large, comb bristles scarce. Longer calcar of hind tibiae about half as long as the metatarsus.

Male unknown.

Habitat: I only know 3 specimens of this species: Borg El-Arab, i., leg. H.C. Efflatoun (coll. Min. Agric.); Suez Road, ii., leg. Ferrante (coll. Alfieri); Wadi Gindali, ii., leg. H. Priesner.

The species *fallaciosus* and *mimus* come nearest to this species, but are larger, have much shorter genae, differently formed propodeum, and have 4-5 comb spines of the metatarsus of the fore legs.

Pompilus litorellus spec. nov.

(Fig. 11)

Female: 8-10.5 mm. — Black, with black pubescence and pilosity; inner orbits mostly with fine short yellowish line in the emargination. Wings very strongly infumated, with still darker apical margin, but *without metallic lustre.*

Eyes emarginated within almost for all their length, similar as in *falla-*

ciosus ; frons above somewhat narrower than below. The eye a little narrower than half of frons. Head, thorax, propodeum and femora only moderately and not densely pilose ; clypeus pilose, truncate in front. Genae conspicuous, but by far not as long as in *calidus ;* frontal sulcus indicated; position of ocelli rectangular, (pol) about as long as (ool); distance of eyes on vertex much greater than length of antennals 2 and 3 combined, but shorter than 3+4. Temples, in lateral aspect, much wider below than above, well half as wide as the eye, below. Antenal joint 3 scarcely longer than 1. Prothorax, viewed from the side, much convex, in dorsal aspect nearly parallel-sided, hind margin not angular. Scutellum and postscutellum rather flat. Postnotum only half as long as the postscutellum, more or less coarsely transversely striate. Propodeum strongly convex, sometimes with longitudinal sulcus visible anteriorly; surface slightly shining, sculpture fine, sides with moderately long pilosity. Tergite I of abdomen steeply declivous in front ; end of andomen on the dorsal and ventral side distinctly pilose, the hairs, however, fine, not stout as in *Anoplius*. Vein Cut1 of fore wing *strongly oblique*, interstitial; pterostigma small; cell r1 not strongly curved, r2 nearly vertical, slightly S-shaped; cell r2 below about as long as r3 or scarcely shorter, 1st abscissa of R almost as long as 2nd, 3rd about only half as long and, therefore, *very short above but not closed,* and Rt3 is strongly curved. Cut of hind wing joining Cu in an acute angle, interstitial; longitudinal veins of fore wing ending far distant from apical margin, even in the hind wing Cu does not reach the margin. Metatarsus of fore legs with *four* slightly flattened (lanceolate) comb spines that remind a little of those of *Schistonyx,* the last of them surpassing the 2nd tarsal joint but not reaching half of the 3rd joint; lower comb spines wanting. Under side of hind tarsi with a double row of very minute spines. The longer calcar of the strongly spiny hind tibiae somewhat longer than half of the metatarsus. Claws with distinct median tooth, pulvillus well developed, about half as long as the claw, comb bristles scarce (about 10), not surpassing the pulvillus.

Habitat: Abukeer (v.), at the sea shore (leg. H. Priesner).

This species can only be referred to the *Arachnospila*-group, though it does not agree in all respects (e.g. pulvillus), another proof for the weakness of the subgenera which were even raised to genera. It may be compared with *marcoticus, calidellus, mimus* and *fallaciosus;* from *calidellus* to which it comes closer by its smaller size, it is distinguished by its much less dense pile, the much finer sculpture of the propodeum, and in having 4 comb spines instead of 3; from the other species it differs by the anteriorly much shorter cell r3, from *fallaciosus* and *mimus*, besides, by the shorter 3rd antennal joint, the smaller size, the apically not vertical but acutely-angled vein Cut of the hind wing, stouter tibial spines, and so on.

Subgenus Pareiocurgus Haupt (Trichopompilus Haupt)

Pompilus calidus Guérin

(Fig. 4)

1812. Unnamed, Savigny, Descr. d'Egypte, pl. 17, fig. 18 (female).
1843. *Pompilus calidus,* Guérin, *Magas. de Zool.,* XIII, p. 5 (p. 114).
1884. *Pompilus teterrimus* Gribodo, *Ann. Mus. Civ. Genova,* XX, p. 385 (female).
1886. *Pompilus atrohirtus* Kohl, *Verh. zool. bot. Ges. Wien,* XXXVI, p. 322, pl. 10, fig. 1 (female).
1933. *Pompilus teterrimus* Haupt, *Boll. Lab. Ent. Bologna,* VI, p. 56, fig. 1 D, 5 (further references).
Trichopompilus teterrimus Haupt, Pomp. Palästinas, MS.
Pareiocurgus calidus Haupt (fide Priesner), Pomp. Palästinas (Nachträge), MS.

Female: 12.5-20 mm. — With legs and antennae black. Abdomen with faint blue sheen, and with brown pruinose pubescence. Head, thorax and abdomen *with dense and long erect pilosity.* Wings blackish brown, with slight blue lustre.

The eye is about one-third as broad as the frons, the latter scarcely sulcate. Clypeus rather long, apical margin narrowly smoothened, fore margin shortly excavated in a shallow arc. *Genae long,* almost as long as the width of the 1st antennal joint. Temples broad, nearly as broad as the eye. Ocelli forming a right angle, (pol) very little shorter than (ool). Antennae slender, joint 3 about 1.5 times as long as 1+2. Pronotum rather short, with callus on each side, obtusely angled at hind margin, the latter somewhat depressed. Postnotum half as long as postscutellum, indistinctly striate, with median sulcus. Propodeum short, strongly convex, with fine longitudinal sulcus and transverse striation that is concealed by the pilosity. Sternite II of abdomen with very shallow transverse depression. Vein Rt1 evenly, Rt3 strongly, curved, nearly obtusely angled, Rt2 straight, almost vertical; 2nd abscissa of R almost twice as long as 3rd; cell r3 below much shorter than r2; Cu of fore wing almost fully attaining margin. Vein Cu1 of hind wing vertical at apex, interstitial or slightly prefurcal. Comb of fore tarsi long, metatarsus with five comb spines, the ultimate one about as long as tarsal joint 2; on the under side, there is only at the extreme apex an accessory one present. Legs strongly spinose; penultimate joint of hind tarsi with a pair of thick, flattened, stout and somewhat paler spines; apical joint of tarsi without spines on the under side. Longer calcar of hind tibiae half as long as the metatarsus. Claws dentate, pulvillus densely set with comb bristles.

Male: 10-14 mm. — Black, abdomen with faint blue sheen, also the pubescence as in the female. Wings hardly bluish. Cells r2 and r3 subequal in length below, r3 strongly narrowed above, r2 only little longer than high. Temples, in lateral aspect, half as thick as the eye. Ocelli forming a blunt angle, (pol) = (ool). Eyes emarginated in the upper third. Genae long.

Pronotum with obtusely angled hind margin. Horizontal portion of the propodeum longer than the declivity, the latter flattened, without wrinkles. Genital plate semi-elliptical, tectiform, with sharp carina. Claws dentate, the tooth not quite vertical. Hind femora without preapical spines, *but the middle femora show two minute spines.* Anterior metatarsus with 4 extremely short comb spines.

Habitat: Fairly common in the desert (xi.-v.). Localities: Abuseer, Fayed; Borgash, Abu Rowash, Mansuria, Kerdasa, Marg, Giza, Dahshour, Sakkara, Suez Road, Meadi, Helouan, Wadi Digla, Wadi El-Tih, Wadi Umm-Assaad, Wadi Hof; El-Wasta. In all available local collections.

Subgenus Galactopterus Arnold

(cf. Arnold, Psamm. Ethiop. Reg., pt. VII, p. 32 (1937), as genus).

Pompilus alfierii spec. nov.

Male: 6.6-7 mm. — Ground black, densely clothed with grey pubescence, excepting segments IV and V, on which dorsally and ventrally the pubescence is dark brown, and tergite VII on which it is yellow; tergite VI yellow or ferruginous at hind margin; tergites II and III may be dark at extreme base (if not contracted). Antennae with black, joints 1 and 2 with grey pubescence. Coxae and tarsi dark, *middle and hind femora ferruginous,* base sometimes blackened, fore legs on upper side or wholly darkened, knees pale. *Wing milky white,* veins brownish for the major part. Tegulae yellow. Head, sides of prothorax, propodeum posteriorly and tergite I laterally sparingly set with whitish hairs.

Clypeus short, truncate in front, touching the eyes laterally. Genae very short. Head triangular in outline, eyes above middle distinctly emarginated within, half as broad as frons. Ocelli forming a slightly obtuse angle. Temples very short, in lateral aspect one-fourth as thick as the eye. Antennae short, joint 3 hardly longer than joint 1. Pronotum strongly transverse, very strongly narrowed towards apex, with sides straight; scutellum slightly convex; postnotum excavated behind, shorter than the postscutellum. Propodeum parallel-sided at base, posterior half rounded and strongly tapering towards apex; anteriorly, there is a broad, shallow sulcus, on the declivity a slight longitudinal elevation; without striation. Abdomen shortly-oval. Cell r2 about rectangular, with veins Rt1 and Rt3 curved, Rt2 very slightly curved and somewhat oblique; cell r3 very strongly narrowed anteriorly, but not closed, one-fourth to one-fifth as long as below; vein Mt3 joins cell r3 in the middle of its base; Cu of fore wing not reaching apical margin. Hind wing with Rt3 strongly oblique, less than half as long as basal part of R; Cut vertical at apex, slightly *postfurcal.* Spur of hind tibiae large, three-fourths or more of the length of the metatarsus. Claws dentate: those of fore legs asymmetrical, i.e. interior claw with a *stout* basal tooth.

Habitat: Wadi Digla (v.), Sakkara (vii.) (coll. Alfieri and Min. Agric.)

This species is congeneric with *Galactopterus rufipes* Arn. (l.c.) of which Dr. G. Arnold was kind enough to send me a specimen for comparison.

Pompilus nubicus spec. nov.

Male: 9 mm. — Body black, with dense decumbent grey pubescence, segments IV-VI with dark brown pubescence; segment VII ivory white; fore margin of clypeus, mandibles, inner and outer orbits, 1st, 2nd and 3rd antennal joint, hind angles (indistinctly also hind margin) of the prothorax, the narrow lateral margins of the scutellum, the whole legs (with brownish tips of tarsi), and the extreme tips of the coxae, *ferruginous;* tegulae and extreme base of the wing veins, the rest of which is dark brown, are *yellow;* wings milky white, pterostigma testaceous with brown margins.

Eye distinctly broader than half of frons. Orbits below parallel-sided for a short distance, slightly divergent towards vertex, little emarginated. (In *P. alfierii* the eyes are divergent from below, more distinctly emarginated). Temples, in lateral aspect, very narrow, about one-fourth as thick as the eye. Clypeus nearly straight at fore margin, touching the eyes laterally. Ocelli forming an obtuse angle, (pol) twice as long as (ool). Frontal sulcus visible. Antennae as in *alfierii,* joint 3 well 2.5 times as long as 2, and 2.5 times as long as thick. Prothorax short, little convex, sides strongly converging anteriorly, slightly rounded, hind margin broadly emarginated, slightly obtusely angled at middle. Postscutellum steeply declivous. Postnotum at least as long as the postscutellum, with median foveola or broad sulcus. Propodeum with dense silvery pubescence (as in the former). Abdomen short, somewhat shorter than thorax + propodeum. Genital segment slender, elevated roof-like, testaceous, without longer bristles. Basal vein straight but little oblique. Cut1 nearly vertical, distinctly postfurcal; pterostigma and cell sc large; veins Rt1 and Rt3 strongly curved, Rt2 straight and vertical; cells r2 and r3 trapezoidal, 1st abscissa of R about one-third to one-fourth of 2nd, this and 3rd subequal in length (also below), r3 below about 1.5 times as long as above, and therefore much longer above than in *P. alfierii;* Cu not reaching apical margin. Vein Cut of hind wing curved hook-like at apex, very slightly prefurcal. The interior claw of the fore tarsi, as in *P. alfierii,* with stout, forwardly directed tooth, the exterior claw with normal tooth. Metatarsus of fore leg almost as long as the three following joints combined, with three vestigial comb spines which are not longer than the apical width of the metatarsus. Apical tarsal joint without spines on the under side, Pulvillus about half as long as claw, comb bristles short, sparse.

Habitat: 1 male, Gebel Elba, Wadi Aideb, 7. iii. 1938 (leg. H. Priesner).

Differing from *P. alfierii* by the pale orbits, antennal and wing base, but particularly in having much broader cell r3 and distinctly prefurcal nervulus (Cut 1); from *P. rufipes* Arn., with which it fairly agrees in the venation, it is distinguished by the finer puncturation of the propodeum, the paler coloration and the larger eyes with not exactly parallel orbits.

Subgenus Nanoclavelia Haupt

(cf. Haupt, Pomp. Palästinas, MS. — Typus: *P. leucopterus* Dahlb.)

Pompilus aegyptorum spec. nov.

(Fig. 12)

Male: 4.5-6.5 mm. — Black, with very fine pruinose pubescence that is whitish grey on head and prothorax and on tergites I-III (or half of III), brownish on the thorax (dorsally) and on the remaining abdominal segments; tergite VII *not* white; propodeum with longer and denser decumbent silvery white pubescence. Legs and antennae black, the latter more or less reddened beneath, the former either wholly black, or fore tibiae and tarsi, and sometimes apices of hind femora and hind tibiae, transparently reddish; calcaria black. *Wings milky white*, with costa and subcosta (=Sc+R+M) dark, all remaining veins *whitish*.

Interior margin of eyes almost parallel for a short distance, but distinctly emarginated above, frons on top much broader than below; eye not quite as broad as half of frons; frons finely sculptured (aciculated), slightly shining, without median sulcus; between the hind ocelli and the eyes there are on the vertex some scattered shallow punctures. Ocelli forming an obtuse angle. (pol) somewhat longer than (ool). Temples *very* short. Clypeus not quite touching the eyes, but the oblique lateral margins not concave, fore margin straight, truncate. Antennal joint 1 short, not longer than broad, joint 2 short, transverse, joint 3 three to four times as long as 2, well twice as long as 1, and joint 4 slightly shorter than 3; the apical antennal joints somewhat obliquely inserted, slightly curved. Prothorax, in lateral aspect, convex, almost forming an obtusely rounded angle, i.e. strongly declivous in front; in dorsal view deeply emarginated, with sides strongly converging towards apex. Scutellum little convex, but sharply-edged laterally, postscutellum on a lower level; postnotum one-third to one-half as long as the postscutellum, transversely striate. Propodeum, in lateral aspect, a little convex, the slightly declivous basal part longer than the apical part. Abdomen short, shorter than the thorax (+propodeum), lanceolate in shape, tergite VII concolorous with the rest. Wings long, pterostigma large, dark; basal vein in its lower portion strongly *convex* (in *lacteipennis* Hpt. scarcely curved), cell sc much higher than cells r; 2nd abscissa of R about twice as long as 1st, 3rd abscissa only one-third (or less) of 2nd, so that cell r3 is strongly narrowed above or closed (not broadly open above as in *lacteipennis*); the three cells r combined at base only little longer than their distance from apical margin of wing; cell r2 below longer than r3; Cu not reaching margin; vein Rt3 ending about at middle of cell r3; cell m3 pointed at its proximal basal angle; Cut1 interstitial or indistinctly postfurcal. Rt3 of hind wing little oblique, Cut slightly S-shaped, in any case curved and vertical apically where it joins Cu, interstitial with Mt2 or slightly prefurcal. Hind femora at upper margin practically with two small spines that may be easily rubbed off. Terminal spines of hind tibiae splayed out. Anterior metatarsus with indication of a medio-lateral and an apical comb spine, and a median inferior spine so that the female will most likely also have a lower comb spine. Calcar of hind tibiae somewhat surpassing middle of metatarsus. Pulvillus slender, pointed, conspicuous without comb hairs. Claws with conspicuous tooth, *fore claws symmetrical.* Genital plate elevated but straight beneath, not convex.

Female unknown.

Habitat: A desert species, collected by me in numbers on inflorescences of *Pennisetum dichotomum.* Localities: Borgash, Abu Rowash, Kerdasa, Pyramids, Wadi Digla, Wadi El-Tih, Wadi Hof, Wadi Assiout (coll. Alfieri, Priesner, Min. Agric.).

The species belongs, as to my opinion, to the group of species which Haupt defined as genus *Nanoclavelia.* I described it as *Pompilus* because the characters prevalent in the *Ctenocerinae* (*Claveliinae*), viz.: serrate or pennate antennae (of male), lack of small spines near apex of hind femora, straight (not splayed out) spines at the apex of the hind tibiae, and not pointed cell m3 of fore wing — cannot be found in this, and most likely also not in Haupt's *Nanoclavelia* spp. The type species of *Nanoclavelia, Pompilus leucopterus* Dahlb., does not agree with the typical *Ctenocerinae* in the essential characters.

P. aegyptorum differs from most likely similar forms, as follows:

N. discrepans Haupt (Tripolitania) has extremely short and slender abdomen, and vein Cut of the hind wing is straight and prefurcal. In the 7-8 mm. long *N. micans* Haupt (Cyrenaica) cells r2 and r3 are combined as long as their distance from the apical margin of the wing, and vein Cut of hind wing is somewhat postfurcal, though it is similar in form with that of our species. In *N. nigra* Haupt (Palestine) Cut of the hind wing is also nearly straight, and the same applies to *N. pulverulenta* Haupt (Tripolitania) which has, moreover, ferruginous legs. *N. argenteonota* Haupt (Cyrenaica) seems also to differ in the shape of the transverse anal vein, but this species comes nearest to *P. aegyptorum*. Unfortunately all these species have not yet been described thoroughly enough to enable me to identify it definitely with it. *Pompilus lacteipennis* Haupt, of which Haupt kindly sent me the original unpublished description, is quite different in having anteriorly broad cell r3, and whitish tergite VII of the abdomen. Kohl's *Pompilus galactopterus* (¹²) also belongs in this group but is distinguished in having the propodeum sparingly whitish pubescent, with comparatively sparingly set puncturation, and the anterior metatarsus without the vestigial comb spines of the under side, and R of fore wing, besides C and Sc, dark.

Pompilus lacteipennis Haupt

(Fig. 31)

1929. *Pompilus lacteipennis* Haupt, *Mitt. zool. Mus. Berlin,* XV, p. 234 (no description; only mentioned in comparison with *P. galactopterus* Kohl).

Description after Haupt (MS.) :

Male : Length 6 mm. Black, rather strongly whitish pubescent and finely pilose. Tegulae, legs from trochanters onwards, (very indistinctly) the inner and outer orbits, reddish brown. Apical abdominal tergite *white.* Wings milky white, opalescent; pterostigma exceptionally large, 1st abscissa of R scarcely half as long as width of pterostigma; the latter, Co and Sc brown, Cu from basalis onwards more or less brownish, the remaining veins white.

Cells r2 and r3 subequal in size, almost symmetrical, as veins Rt1 and Rt2 are curved, Rt2 straight; Cut1 interstitial; 4th abscissa of R rather straight, obliquely ascending. Hind wing with Cut rather strongly curved before apex and somewhat prefurcal.

Head rather thick and with large eyes, somewhat broader than the scutum at the shoulders, in dorsal aspect rather abruptly narrowed from posterior third of eyes onwards; temples nearly flattened, in lateral aspect very narrow, one-fifth as thick as the eyes. Ocelli forming an obtuse angle, (poi) : (ool) = 2 : 1. Frons lentiformly convex, with fine leathery sculpture, and distinct shining median sulcus; one eye equalling four-fifth of half of frons, slightly emarginated medianly, and narrowed towards apex; genae short, strongly narrowed anteriorly. Antennal joints distinctly separated, becoming gradually shorter from joint 3, the latter somewhat longer than joint 1, and twice as long as thick. Clypeus short, very little convex, fore margin straight. Pronotum short, slightly obtusely angled at hind margin, much declivous anteriorly, sides convergent and flatly rounded. Scutum with conspicuous notauli, lateral parts obtusely angled by the tegulae, and posteriorly with distinctly raised margin. Cuneoli short, cuneiform. Scutellum distinctly cushion-shaped, postscutellum deeper, hump-backed, higher than the postnotum; the latter finely transversely striate, impressed at middle and almost as long as the postscutellum, widened at the sides, almost as in *Episyron*. Propodeum with fine leathery scuplture,

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(¹²) *Pompilus galactopterus* Kohl. — From the type (coll. Mus. Vienna) the following characters may be added: Male. — Propodeum with sparse whitish pubescence and comparatively sparingly set puncturation. Postnotum somewhat narrowed in the middle, well developed, about half as long as the postscutellum. The metatarsus of the fore legs has no indication of a lower comb spine. Genital plate rounded at apex, flattened beneath. C and (Sc+R+M) dark, R also dark, cell sc, therefore, surrounded by dark veins. Patria: Caucasia.

dull, with fine white, almost velvety pubescence, and with fine median sulcus; its anterior part little convex and also little declivous, its posterior third rather steeply declivous. Abdomen very little pubescent, somewhat shorter than thorax + propodeum. Interior calcar of hind tibiae scarcely half as long as the metatarsus. Claws elongate, for two-thirds of their length evenly wide, apical third excavated, not dentate. Pulvillus half as long as the claws, comb hairs wanting. Genital plate slightly narrowed towards apex, folded roof-like, carina flattened, preceeding sternite excavated by an acute angle.

Patria : 1 male, Bukhemmekh, Tripolitania (leg. G. Krüger ; type in coll. Mus. Bengasi).

Sugbenus Sophropompilus How.

Pompilus illiberalis Haupt

(*Sophropompilus illiberalis* Haupt, Pompiliden Palästinas, MS.)

Female : 9-9.5 mm. — Black, antennae and legs black, wings slightly shaded, with black apical margin, hind wings pale, with dark apex. Abdomen red, base or the whole segment III and the apex of the abdomen dark; segment I grey pubescent at base, segments II and III with transverse basal band of grey pubescence. Frons and occiput densely white pubescent, occiput white pilose. Prothorax at fore margin broadly, at hind margin narrowly, whitish grey pubescent, and with a fine grey median line, joining the two transverse bands. Notauli behind, sides of scutellum and sides and posterior part of the propodeum, with white-grey pubescence. Legs finely grey pubescent.

Clypeus short and broad, laterally touching the eyes, broadly truncate in front. Antennae short and stout, joint 3 somewhat shorter than 1. Eyes emarginated within, only little broader than half of frons. Ocelli forming a right angle, anterior ocellus in a small foveola; frons with fine sulcus. Temples short, in lateral aspect, about one-third of width of eye. Genae scarcely developed; vertex declivous right behind eyes, occiput bluntly edged; (pol) = (ool). Pronotum with sides straight or slightly concave and narrowed towards apex, in lateral aspect distinctly convex, strongly declivous in front, hind margin forming a broad arc, not depressed. Lateral parts of scutum not distinctly raised. Postnotum conspicuous, only anteriorly with short sulcus. Propodeum short, broader than long, slightly excavated behind, with distinct median sulcus, with a slight callus in front of hind angles; in posterior third, dorso-laterally, the propodeum shows a short oblique sulcus or impression on each side. Legs stout, anterior metatarsus about as long as joints 2+3, with three dark comb spines, the third of them somewhat longer than tarsal joint 2, slightly surpassing tip of it, besides, with a single inferior comb spine in the middle of the under side. Hind tibiae with few spines. Ultimate tarsal joint on under side with a double row of small spines (which are vestigial in the male). Claws dentate, pulvillus small, slender, comb bristles weak, few. Apical abdominal tergite with a few weak hairs. Pterostigma *small;* vein Rt1 curved, Rt2 slightly so, Rt3 strongly oblique so that cell r3 is very narrow above, nearly closed ; Cut1 interstitial or slightly postfurcal ; longitudinal veins remain far apart from wing margin ; Rt3 of hind wing oblique, one-third as long as its distance from base of R ; vein Cut interstitial, semicircularly curved at apex, vertical upon Cu.

Male: 8 mm. — Coloration and distribution of pubescence as in the female. Wings slightly shaded with darker apical margin. The inner orbits are somewhat concave (eyes convex) below, convex above. The eye is, across antennal bases, broader than half of frons, in the excavation it is about as broad. Position of ocelli obtusely angled, (pol) somewhat longer than (ool). Frons with more or less deep fine sulcus. Antennae short, joints 3 and 4 subequal in length, each shorter than 1. Venation as in the female. Propodeum with fine median sulcus, with raised, blunt, densely white pubescent hind angles, with slight impression posteriorly, but without oblique laterodorsal sulcus. Apical segment contracted, genital plate slightly visible, not carinated, slightly rounded at apex or truncate, at margin set with very short, stiff, black bristles, beneath with some short, erect bristles. Calcaria of hind tibiae about three-fourth as long as the metatarsus. Tibial spines stout. Claws dentate.

Habitat: I have seen specimens from Borgash, Megadla, Kerdasa, Mansuria, Gebel Asfar and Meadi, and also from the Wadi Gederât in the Sinai. The species is uncommon.

Distribution: Egypt, Palestine.

Although Haupt states in the description that the wings are nearly hyaline with blackish margin, and he does not mention the oblique furrow at the sides of the propodeum, I consider our specimens to be identical with Haupt's.

The species is also similar to, and no doubt congeneric with, *argenteodecoratus* Cam. from Southern Rhodesia, which Arnold (Psamm. Ethiop. Reg., pt. VII, 1937, p. 21, fig. 14) puts as subgenus *Asthenoctenus* to the genus *Dicyrtomellus.*

Our species is in any case congeneric with *P. subarcuatus* Schenck (Europe) and therefore a *Sophropompilus.*

Species of POMPILUS which have not yet been assigned to Subgenera

Pompilus arcanus spec. nov.
(Fig. 14)

1812. Unnamed, Savigny, Descr. d'Egypte, pl. 18, fig. 13, female.

A very characteristic species.

Female: 7-7.5 mm. — Black, 1st, 2nd and mostly also 3rd abdominal segment red, segments 2-4 with narrow postero-marginal band of grey pubescence; head and thorax above with brownish, clypeus and propodeum with white-grey pubescence, and also the coxae so. Legs black, mostly reddish transparent. On the propodeum the pubescence is arranged in different directions, lengthwise anteriorly, transversely in the middle, and lengthwise again laterally and posteriorly. Fore wings slightly shaded, with dark *subapical* band that reaches the cells nearly or wholly, but leaves the apical margin milky white.

Head, in anterior aspect, roundish, broader than long, eyes large, much broader than half of frons, orbits emarginated, frons below about as broad as above. The fine sulcus of the frons only visible above antennal cavities. Genae very short, clypeus touching the eyes. Temples, in lateral view, hardly half as thick as the eye, with adpressed pubescence and raised grey hairs. Ocelli forming a right angle, (pol) somewhat longer than (ool). Antennal joint 3 somewhat longer than 1 and 2 combined. Pronotum, in lateral aspect, little convex : hind marginal excavation forming an obtuse angle. Scutellum not flattened above, postscutellum scarcely deeper. Postnotum *somewhat longer* than the postscutellum, distinctly pubescent, with fine, sharp median sulcus. Propodeum slightly convex, *very finely* transversely striate in the middle of the posterior half. Vein Cut1 interstitial or hardly postfurcal; cell sc small, 3rd abscissa of R almost parallel with fore margin of cell sc, about as long as 4th; vein Rt1 and Rt3 slightly curved, Rt2 *straight, but oblique*, cell r2 *triangular,* r3 *high, forming an erect rectangle.* Pterostigma *short, small,* but still cell-shaped, i.e. transparent and brownish in the center. Cu of fore wing ending far distant from apical margin. Vein Cut of hind wing only slightly curved, joining Cu in a pointed angle, prefurcal. Anterior metatarsus with three black comb spines of which the ultimate one surpasses the 2nd tarsal joint ; without comb spines on underside ; apical tarsal joint with distinct double row of small spines. Claws distinctly dentate, pulvillus moderately large, with few comb bristles. The longer calcar of the hind tibiae somewhat shorter than half of the metatarsus.

Male : 4.5-5 mm. — 1st and 2nd abdominal segment dusky red at base, the rest dark, but with rather broad pale grey apical fasciae. Propodeum little convex. Antennal joint 2 somewhat longish, 3 well twice as long as thick. Wings as in the female. Rows of spines on apical tarsal joint (below) vestigial. (Genital plate not well visible). Abdomen slender.

Habitat: Uncommon (v.-xi.). Localities: Kerdasa, Khatatba, El-Warrak, Gebel Asfar, Giza, Meadi, Helouan.

Pompilus arens spec. nov.

Female: 7.5-8 mm. — Head and thorax black beneath pubescence, clypeus ferruginous in anterior half, mandibles yellow with black tip, prothorax in the middle of the hind margin sometimes narrowly reddish: antennal joint 1 reddish, rest of antennae reddened beneath; coxae beneath, femora and tibiae ferruginous, tarsi blackened; abdomen ferruginous, apical tergite or also penultimates darker, with paler apical margins; fore wing only slightly shaded, with darker apical margin that slightly enters only cell sc, not the cells r. The body is clothed with a dense greyish pubescence that is more yellowish and pruinose only on the abdomen.

Legs and antennae stout so that this species comes nearest to *Anospilus compactus* sp. n., described below, but it has longer tarsi and differs from the latter, besides, by the strongly prefurcal transverse anal vein (Cut) of the hind wing. The eye about as broad as half of frons; median line of frons conspicuous, interior orbits nearly parallel below, distinctly emarginated above. Clypeus broad, nearly touching the eyes, indistinctly emarginated in front. Temples, in lateral aspect, widened downward, apically about half as thick as the eye, without raised hairs. Ocelli forming an obtuse angle, (pol) distinctly longer than (ool). Genae short. Antennal joint 3 distinctly a little longer than 1+2., the latter short, joint 4 as long as 1. Prothorax distinctly convex, in dorsal aspect narrowed anteriorly with straight sides, hind margin forming a flat arc. Scutellum little convex, *postnotum not visible in the middle.* The horizontal portion of the propodeum longer than the declivity, the latter slightly deepened, median sulcus almost percurrent. Apex of abdomen without raised hairs. Basalis of fore wing curved, vertical upon Cu, vein Cut1 somewhat postfurcal; C and Sc blackened like the pterostigma; vein Rt1 curved, Rt2 straight, somewhat oblique, Rt3 strongly oblique, somewhat curved; cell r2 much longer than r3 (1.5-2 times as long), r3 above very narrow, nearly closed, about one-fourth as long as below; 2nd abscissa of R 1.5 times to twice as long as 1st, 3rd abscissa about one-third of 1st; Cu of fore wing ending far from apical margin. In the hind wing the basal portion of R is twice (or more) as long as vein Rt3; vein Cut of hind wing flat, joining Cu in a pointed angle and being distinctly somewhat prefurcal. Anterior metatarsus on one side with three, on the other with four short, brownish comb spines, the apical of which reaches the middle of the 2nd tarsal joint or surpasses it a bit; there is one short median inferior comb spine present and a short apical inferior one. Spines and calcaria of middle and hind legs darkened, the longer calcar about two-thirds as long as the metatarsus and slightly reddish transparent. The small spines on the under side of the apical tarsal joint present though very small; pulvillus moderately long, slender, comb bristles short, claws with small blunt tooth.

Male unknown.

Habitat: 1 female, Wadi Umm-Assaad, about 40 km. east of Meadi, 14.x.1934, leg. H. Priesner.

It is possible that this species, after the male will have been discovered, will have to be transferred to *Anospilus*.

Pompilus astutus spec. nov.

(Fig. 15)

Female: 6-7.5 mm. — Shortly built, stout. Black, with yellowish grey pubescence of the anterior body, the abdominal segments with broad, grey ill-defined apical transverse fasciae, segment IV (much retracted) only indistinctly grey pubescent. *Legs ferruginous*, middle and hind coxae marked with reddish exteriorly, tarsi darkened, fore tarsi only at apex so. Antennae black, mandibles red, with black tips, palpi dark. Wings very slightly shaded, with broad blackish apical margin that reaches cell sc but not the other cells.

Head broader than prothorax, eyes slightly emarginated within, the eye narrower than half of frons. Clypeus broad, touching the eyes, nearly truncate at fore margin. Genae very short. Temples, in lateral aspect, less than one-half but more than one-third as thick as the eye. Antennal joint 3 as long as 1+2, joint 4 somewhat longer than 1. Prothorax short, convex, sides nearly parallel at base, strongly constricted at fore margin, without median line or marginal depression. Postnotum only half as long as the postscutellum, shining, very slightly emarginated in the middle. Propodeum short, broader than long, shining, parallel-sided only at base, then gradually rounded, tapering, slightly flattened on the declivity, with conspicuous median sulcus. Abdomen short (segments much conctracted). Vein Rt1 strongly curved, Rt2 almost vertical, straight, Rt3 curved backward anteriorly; cell r3 above only one-third as broad as below; vein Mt3 joining M in or behind middle of cell r3. Vein Cut1 interstitial or scarcely prefurcal; Cu of fore wing not quite reaching apical margin. In the hind wing vein Rt3 is about one-third as long as the basal part of R. Vein Cut of hind wing slightly curved and prefurcal. Anterior metatarsus with *four long and yellow comb spines, and with two to three median inferior comb spines;* the apical lateral comb spine surpasses the middle of the third tarsal joint and is 1.5 times (or more) as long as the 2nd tarsal joint. Claws distinctly dentate. The longer calcar of the hind tibiae is more than half as long as the metatarsus.

Male: 5.5 mm. — Black, hind femora and tibiae ferruginous, base of hind femora and extreme apex of tibiae darkened, middle femora black, somewhat reddened exteriorly, fore legs and all tarsi black. Body with fine grey pubescence that does not wholly cover the ground; *abdomen brownish pubescent, the posterior margin of segments I and II broadly grey pubescent.*

Wings hyaline at base, gradually darkened towards apex, inclusive of cells. Hind wings only slightly shaded at apex.

Head broader than thorax; width of eye somewhat less than half of that of the frons, the latter below much narrower than above; orbits emarginated interiorly. Genae short. Clypeus reaching eyes but not quite the mandibles, not emarginated in front. Vertex with some white raised hairs. Temples, in lateral aspect, very narrow, only about one-fifth of width of eye. Antennal 2 about as long as broad, joint 3 one and one-half times as long as 2, about as long as 1. Sides of prothorax strongly narrowed towards apex, hind margin slightly arched; in lateral aspect, the pronotum is scarcely convex. Scutellum flat, postnotum strongly shining, about half as long as the postscutellum. Propodeum short, somewhat shining, strongly narrowed towards apex, at hind margin with a foveola on both sides of the middle; without median sulcus. Addomen shorter than the thorax, segment VII not whitish. Pterostigma conspicuous, forming a small cell. Vein Cut1 scarcely prefurcal; vein Rt1 and Rt3 curved, Rt2 straight, vertical, 2nd abscissa of R 1.5 times as long as 1st, 3rd at most half as long as 2nd; cell r3 below a little shorter than r2, strongly narrowed above; cell sc large, higher than cells r. Vein Cut of hind wing not vertical, slightly prefurcal. Anterior metatarsus scarcely as long as the joints 2-4 combined. Apical joint of hind tarsi with only one pair of very short inferior spines. Longer calcar of hind tibiae black, long, about two-thirds of the metatarsus. Pulvillus moderately large, lanceolate, comb bristles visible but scarce. Tooth of claws very small, on the fore tarsi the claws are subequal, symmetrical.

Habitat: Fayoum (ii.), coll. Alfieri, coll. Priesner.

Pompilus croceus spec. nov.

Female: 7.5-9 mm. — The whole body ferruginous, only the abdominal segments from 3rd onwards darkened. Tarsi dark towards apex. Coxae ferruginous. Antennae ferruginous at base, dark about from apex of joint 3 to tip. Fore wings with brownish infumation, cells m1 and cu1 lighter, one specimen has a somewhat more strongly marked dark apical margin. Hind wings pale, with slightly darkened apex.

Eyes above distinctly less far distant than below, the eye somewhat narrower than half of frons. Clypeus strongly transverse, practically touching the eyes, evenly rounded in front. Genae very short. Ocelli forming a right angle, (pol) : (ool) = 5 : 4. Temples, in lateral aspect, scarcely thicker than half of eye. Antennal joint 3 longer than 1 + 2. Pronotum broadly emarginated posteriorly, somewhat obtusely angled, with visible median sulcus and slight marginal depression. Scutellum convex, postscutellum almost as long as postnotum, the latter with deep median sulcus. Propodeum normal, parallel-sided at base, slightly tapering in apical half, dull and aciculated like the rest of the thorax, without median sulcus and without striation. Apical sternite with some raised black bristles and several shorter ones. Cell r1 below longer than r2, about twice as long as above; vein Mt2 joining M behind middle of cell r2, vein Mt3 in the middle of r3; vein Rt1 evenly curved, Rt2 straight, Rt3 almost angularly curved; cell r3 above less than half as long as below; vein Cut1 interstitial; Cu of fore wing ending far from apical margin. Rt3 of hind wing strongly oblique, its lengths more than one-third of that of the basal part of R; vein Cut semicircularly curved at apex, slightly but distinctly prefurcal. Fore tarsi with *three* moderately long comb spines, the apical of which having about two-thirds the length of the 2nd tarsal joint; lower comb spines wanting. Apical tarsal joint with a row of small spines at the interior margin of the under side. Longer calcar of hind tibiae about half as long as the metatarsus. Claws distinctly dentate, pulvillus slender, scarcely half as long as the claws, with few comb bristles.

Male unknown.

Habitat: Gebel Asfar (2.vii.1934), Abu Zabal (21.vi.1934) (leg. and coll. Alfieri).

This species, probably belonging to the subgenus *Arachnospila,* seems to come near to *P.* (*Arachnospila*) *illustris* Haupt (Palestine), but differs by the smaller size and especially in having only three comb spines of the anterior metatarasus, instead of four. From *P. rutilus* it is easily distinguished by the normally rounded clypeus, the smaller size and the lighter propodeum.

Pompilus curtiventris spec. nov.

Male: 6.7 mm. — Anterior body black on the ground, antennae at base beneath ferruginous, and inner orbits with a short reddish line; legs, tips of the black coxae and metatarsi (more or less), ferruginous; tarsi blackened. Abdomen ferruginous, tergite I with dark basal spot, tergite VII white-yellow. Mandibles red. Head and thorax with whitish grey silky pubescence, on the propodeum this pubescence is transversely directed. Wings hyaline, with narrow grey apical margin that only reaches cell sc; the extreme apical margin is only quite indistinctly paler; veins dark, pterostigma testaceous.

Rather similar to the male of *rhodosoma* Kohl, but differs, apart from the coloration, by the following characters: The antennae are somewhat longer, joint 3 being twice as long as the slightly transverse joint 2, and about as long as joint 4 or 5, more than twice as long as broad. Cell r3 is narrower above, less than half as long as r2, below it is shorter than r2;

Cu of fore wing does not reach the apical margin; vein Cut of hind wing vertical at apex or even slightly reflexed, nearly interstitial (scarcely prefurcal); Cut has a short appendical vein on both wings, though this may be abnormal. Calcaria as in *rhodosoma.* The apical joint of the tarsi has no inferior spines, and the fore tarsal claws are asymmetrical.

Female unknown.

Habitat: Kerdasa, 5.v.1935 (leg. H. Priesner).

This species cannot be the male of *P. desertorum,* owing to the early fading out Cu of the fore wing.

Pompilus waltli Spinola

(Fig. 5)

1838. *Pompilus waltli* Spinola, *Ann. Soc. Ent. France,* p. 462 (male).

Male: 5-7 mm. — In pale specimens the pronotum, scutum and scutellum are ferruginous or pale brown, and of the same colour are the inner orbits, the apical parts of the clypeus, the labrum and the mandibles, also the palpi (with darker base), 1st antennal joint, under sides of joints 2 and 3 and the legs, whereby the hind legs may be dull reddish ; calcaria and tarsi of middle and hind legs dark. Propodeum and abdomen black, the narrow hind margins of the segments reddish; *segment VII whitish yellow*; in small specimens the abdomen is wholly black, the scutellum red only in the middle, and the scutum at apex so, on the head only the orbits red, clypeus and palpi dark, etc.; or the thorax may be black, and only the pronotum red, or darkened in the middle; such specimens are transitions to f. *specialis* nov. Wings darkened at apex to the cells, but the extreme apex is again hyaline. Hind wings hyaline.

Antennae stout, in small specimens shorter. Frons strongly convex ; ocelli forming an obtuse angle, (pol) : (ool) = 3:2. The eye little narrower than half of frons. Clypeus reaching eyes laterally, slightly rounded in front. Prothorax in perfect specimens, propodeum always, with silvery pubescence, less conspicuous and more grey is the pubescence on the abdomen, strongest on tergite I. Hind margin of prothorax angular at middle, broadly emarginated. Scutellum long, postnotum on a lower level, emarginated behind, shorter than the postscutellum, transversely striate, white pubescent. Propodeum long, tapering towards apex. Wing comparatively long, pterostigma large, more than half as long as cell sc, the latter large; cell r3 about as long as r2; veins Rt1 and Rt3 curved (the latter sometimes strongly so) ; vein Mt2 ends behind, Mt3 in the middle of the respective r cells, Mt3 strongly curved ; Vein Rt3 of hind wing oblique, basal portion of R about 2.5 times as long as it ; vein Cut of hind wing semicircular at apex, interstitial or scarcely prefurcal. Cu of fore wing does not attain the apical margin. Longer calcar at least as long as half of metatarsus. Apical tarsal joint without inferior spines. Claws dentate, pulvillus slender.

P. waltli var. specialis nov.

Male: 5-6 mm. — Black, with fine silvery pubescence, especially on the propodeum ; the inner and often also the outer orbits, more seldom the hind angles of the prothorax and the tegulae, as well as antennal joint 1 beneath, ferruginous; anal segment and genital plate pale. Legs testaceous, the fore tibiae mostly with external dark line ; all femora black at base, tarsi blackened towards apex or more extensively so. Wings hyaline with pterostigma testaceous or brown, and with broad dark subapical fascia, leaving the wing tip hyaline, and about half filling cell sc, and sometimes also entering the cells r.

Antennae short, joint 2 about as long as broad, 3 well twice as long as broad, little longer than 4. Clypeus and frons with silky pubescence. Eyes a little narrower than half of frons, slightly emarginated interiorly. Ocelli forming a slightly obtuse angle. Genae and temples short ; the latter strongly oblique and short, in dorsal aspect. Prothorax very strongly narrowed anteriorly, posterior emargination shallow, somewhat angular in the middle. Scutellum high, vertical posteriorly. Postnotum nearly as long as the postscutellum, with median sulcus or foveola. Propodeum only little convex, not sulcate, densely and wavily clothed with silky adpressed pile. Abdomen with fine pruinose grey pubescence, the hind margins of the segments very narrowly ferruginous. Genital plate raised and carinated beneath, distinctly incised at apex. Cells r2 and r3 subequal in length above and below, though longer there than above; veins Rt1 and Rt3 curved, Rt2 vertical and straight; Cut1 (as in the typical form) interstitial, nearly vertical; vein Cut of hind wing strongly curved at apex, nearly vertical, about interstitial. Pulvillus slender, half as long as claws, tooth of the latter small, blunt.

I gave a full description of this form with the intention of showing that there are no specific differences apparent between it and *P. waltli* Spin. I consider *specialis* to be only an exceptionally dark variety of *waltli*.

Habitat: Borgash, Abu Rowash, Pyramids of Giza, Gebel Asfar, Wadi El-Tih, Wadi Digla, Wadi Hof, Wadi Assiouti ; Gebel Elba (Wadi Aideb). (iii.-ix.). *P. waltli* var. *specialis* I collected in the Wadi Digla (iv.) and at Fayed.

Pompilus signatipennis Klug

1834. *Pompilus signatipennis* Klug, Symb. phys., pl. 38, fig. 11 (male).

Male: 6-7 mm. — Body, legs and antennae black; antennal joints 3-5 sometimes slightly brownish beneath, the hind margins of the abdominal segments faintly brownish transparent, tergite VII white-yellow, at least posteriorly. Body finely covered with brown pruinose pubescence, propodeum with silvery-white decumbent pubescence, sometimes also the sides of the scutellum and postscutellum with similar pubescence. Wings hyaline or scarcely shaded, with broad dark subapical fascia that does not quite reach the cells, and leaves the apical margin narrowly hyaline.

Clypeus evenly rounded anteriorly, touching the eyes laterally. Orbits slightly emarginated within, the eye as broad as half of frons; *the latter below narrower than above;* head, as a whole, slightly broader than long ; ocelli forming an obtuse angle, (pol) subequal to (ool). Temples, in lateral aspect, about only one-third as thick as the eye, also very short from above. Antennal 3 longer than 1+2, about four times as long as 2, joint 4 well as long as 1 and 2 combined, 1 stout, strongly convex beneath. The penultimate joints somewhat obliquely inserted. Prothorax strongly narrowed towards apex, sides straight, surface flattened, slightly declivous in front, hind margin forming a shallow arc. Scutellum rather flat, lateral margins rather sharp-edged. Notauli only slightly incised, scutum at the sides of them very narrow. Postnotum at most half as long as the postscutellum, transversely striate, without sulcus, only slightly narrowed at the middle. Postscutellum, in lateral aspect, strongly convex, scarcely lower than the scutellum. Propodeum only slightly convex, its adpressed pilosity outwardly directed posteriorly. Abdomen short, about as long as or shorter than head and thorax combined, lanceolate in shape. Cell r3 of fore wing below as long as or somewhat shorter than r2; above it is narrow, one-third to one-half the length of r2; cell sc higher than cells r; vein Cut1 interstitial; Cu of fore wing not reaching apical margin. Vein Cut of hind wing semicircularly curved at apex, vertical upon the Cu, interstitial or slightly postfurcal. Claws with minute tooth that is situated behind middle. Hind tibiae feebly spinose. Calcar varying in length up to more than half of metatarsus. Apical tarsal joint without rows of bristles on the under side.

Female unknown.

The species belongs in the same group as *P. waltli* Spin., and may be assigned to Haupt's « *apicalis*-group ».

Our species agrees well with the description and illustration given by Klug (l.c.). From the illustration it appears that the darkening of the wing is situated somewhat preapical, in form of a preapical fascia. The transverse anal vein (Cut) of the hind wing is shown postfurcal. The stigma is large.

Habitat: Abu Rowash (leg. A. Alfieri); Wadi Hof, Wadi Assiouti (coll. Min. Agric.) ; Gabal Ataqa (Ein Shams Univ.) ; Wadi Gerawi (H.

Priesner). Uncommon (iv., v., viii., and x.).

Pompilus mochianus spec. nov.

Male: 6-6.5 mm. — Body, legs and antennae black. Pubescence fine, pruinose, ground visible, except on clypeus and frons below, where the pubescence is dense and silvery white. Fore wings hyaline, slightly shaded towards apex, with apical margin broadly dark, the darkening slightly entering cell sc, but not the cells r and m; hind wing only slightly shaded at apex; veins dark, less so in hind wing. Mandibles ferruginous in apical half. Vertex and thorax above with brownish pubescence.

Head roundish, in frontal aspect; clypeus truncate in front, almost reaching the eyes laterally. Genae short. Eyes below somewhat convex, above somewhat concave, the eye in the excavation a little narrower than half of frons; the latter with fine median sulcus. Ocelli forming an obtuse angle, distance between hind ocelli little longer than that between hind ocellus and eye. Temples, laterally, narrow. Antennae short, stout, joint 2 about as long as 3, joint 4 a little longer. Prothorax narrowed towards apex, broadly emarginated behind. Scutellum broad, flattened dorsally, *postscutellum with median sulcus;* postnotum somewhat incised behind, with deep median sulcus, shining, only finely transversely striate, as long as the postscutellum. Propodeum normal, with very fine median line. Abdomen *somewhat longer* than the thorax, not very slender, but not as shortly elliptical as e.g. in *rhodosoma,* tergite VII not whitish, dark. Genital plate slender, not carinated. Fore wings with vein Cut1 (nervulus) *curved,* slightly postfurcal; pterostigma well developed; cell r3 below one-third shorter than 2, above about as long as it, since vein Rt1 is *angularly bent;* cell r3 somewhat higher than long, veins Rt2 and Rt3 slightly curved; none of the wing veins reaches the apical margin, though Cu of fore wing comes near to it; Rt3 of hind wing about half as long as the basal part of R, vein Cut slightly curved, *joining Cu in a pointed angle, prefurcal.* 1st joint of fore tarsi about as long as the three following joints combined. Longer calcar of hind tibiae very long, not quite as long as the metatarsus. Apical joint of hind tarsi bare on the under side. Claws with minute tooth, pulvillus small and slender.

Habitat: Gabal Asfar (8.iv.1937), leg. A. Mochi.

Pompilus murinus spec. nov.

Male: 4-6.5 mm. — Body, antennae and legs black, rather densely clothed with grey to yellow-grey decumbent pubescence. Hind margins of the tergites scarcely and narrowly reddish transparent. Wings almost hyaline, with subapical darkening that leaves the apical margin very narrowly hyaline. Veins dark, pterostigma dark, moderately large. Mandibles reddish at apex.

Eyes distinctly narrower than half of frons. Clypeus in front very slightly emarginated, not quite reaching the eyes, laterally. Genae visible, but half as long as antennal joint 2. Frontal sulcus feeble, frons below somewhat narrower than near vertex. Ocelli forming an obtuse angle, (pol) about twice as long as (ool). *Temples extremely short,* laterally only one-fifth to one-fourth of width of eye. Antennae short and stout, joint 1 comparatively long, somewhat curved, twice as long as the well developed joint 2, the latter about as long as 3, joint 4 longer than 2 or 3. Prothorax appearing longish, narrowed anteriorly, sides straight, not quite twice as broad at hind margin as long; basal margin nearly straight, very shallowly emarginated; in lateral aspect, the prothorax is strongly convex. Scutellum flattened above, *postscutellum lying much deeper, flat, not protruding in lateral aspect, postnotum not visible.* Propodeum parallel-sided at base, strongly tapering towards apex, *slightly excavated behind* so that the angles protrude a little; only slightly convex in lateral aspect. The pubescence of the propodeum is directed backward laterally. Abdomen shorter than the thorax, densely grey pubescent, the posterior segments (3 or 4-6) are covered with a brownish pubescence. Apical tergite not white. Cell sc somewhat higher than the cells r; basal vein distinctly curved (nearly twice so), vein Cut1 interstitial; veins Rt1 and Rt3 curved, Rt1 strongly so; cell r3 below and above shorter than r2, above only half as long as below or even almost closed; Cu of fore wings comes rather close to the margin. The basal portion of R in hind wing is 2.5-3 times as long as Rt3; vein Cut of hind wing slightly curved and joining Cu in an acute angle, not vertical, strongly prefurcal. Metatarsus of the fore legs somewhat shorter than the three following joints, or the three apical joints, combined. Apical tarsal joint bare on the under side. Longer calcar of hind tibiae about only one-fifth shorter than the metatarsus. Pulvillus very small, slender. Claws dentate.

Habitat: Kerdasa (3.xi.1926), leg. Alfieri; Abu Rowash (30.v. 1937), leg. H. Priesner.

Pompilus tomentosus spec. nov.

Male: 8.5-11 mm. — Black with abundant grey pubescence, i.e. nearly on the whole body except the dorsal part of the scutellum, the sides of the middle and hind coxae, and (more or less broadly) the base of the tergites; broadest dark remains the base of the 2nd tergite where the pubescence is brownish; tergite V wholly dark, tergites VI and VII with grey pubescence. Head, antennal 1 exteriorly, postscutellum, propodeum (especially at the sides and behind) and tergite I at base, *with raised, moderately long black* hairs. Antennae and legs black; antennal 1 with grey, legs with brownish, pubescence. Wings almost hyaline or very slightly shaded, hind wings hyaline, both with dark apical margin. The small specimens have a short yellow line at the inner orbits.

Eyes almost a little broader than half of frons. Frons above broader than below. Eyes below slightly convex within, above distinctly somewhat emarginated. Genae short, clypeus practically touching eyes. Ocelli forming a right angle, in large specimens a slightly acute one. Distance between hind ocelli subequal to that between hind ocelli and eyes. Temples, in lateral aspect, less than half as thick as the eyes. Antennal joint 3 as long as joints 1 and 2 combined. Prothorax short, sides narrowed towards apex in a stright line. Postnotum about half (or somewhat more) as long as the postscutellum, black, evenly wide, with fine transverse striae and median sulcus. Propodeum little convex, with declivity scarcely depressed, and in the upper portion the propodeum shows a conspicuous sulcus. Cu of fore wing reaching margin as a trace only ; Cut1 interstitial or *slightly prefurcal;* pterostigma very moderately large, though about as broad as the space between Co and Sc; veins Rt1 and Rt3 curved, cell r3 above one-half to one-third as long as below; Cu of fore wing not distinctly reaching the margin ; vein Cut of hind wing semicircularly curved at apex, vertical upon Cu, scarcely or distinctly postfurcal. Longer calcar of hind tibiae longer than half of the metatarsus. Apical tarsal joint without spines on the under side. Pulvillus normal, about half as long as the claws, slender, comb bristles not very numerous, about as long as the pulvillus. Claws distinctly dentate; inner claw of fore tarsus more strongly curved than the outer, with stouter (basal) tooth.

Female unknown.

At first sight the insect reminds somewhat of *Dicyrtomellus luctuosus* Mocs., but is easily separated by the somewhat larger pterostigma, the longer raised pilosity of the body, the ocellar triangle (right to acute), denser and paler pubescence of the body, but more brownish instead of grey pubescence of the tibiae, strongly narrowed cell r3 and much longer postnotum.

The larger specimens from the Sinai peninsula and the Wadi Rashrash have wholly dark orbits and the pilosity of the body is a little longer.

Habitat: Kafr Hakeem, Suez Road; Sinai (Kosseima); Gebel Elba (Wadi Aideb), in coll. Min. Agric. and Alfieri (iii., v., vii and xi.).

Pompilus sayedi spec. nov.

(Fig. 13)

Male: 5 mm. — Black, body with fine grey pubescence that is more conspicuous on frons and clypeus, at the sides of the prothorax and metanotum, at the sides and hind margin of the propodeum, so that on the latter there appears a large apparently bare spot in the middle. The black ground is else visible nearly everywhere. Mandibles reddish at tip. Wings hyaline, with broad apical infumation that is not sharply defined, reaches the cells and enters somewhat the cell sc. Antennae and legs (inclusive of calcaria) black.

Interior orbits narrowed downwards so that the frons is above much broader than below: the emargination above is extremely slight. Genae short, mandibles and clypeus not quite touching the eyes; clypeus truncate in front. Ocelli forming an obtuse angle, distance of hind ocelli equalling that between ocelli and eyes. The eye is about half as broad as the frons. Temples, in lateral aspect, less than half as broad as the eye. Maxillary palpi long, dark. Mandibles with one preapical tooth. Antennae moderately long, joint 3 scarcely twice as long as 2, about as long as 1, twice as long as broad, and subequal to 4 or 5. Prosternum with a few raised white hairs. Prothorax vertically declivous in anterior half, broadly and shallowly emarginated behind, scarcely angular, sides narrowed towards apex. Notauli very feebly impressed. Suture between scutum and scutellum deep. Scutellum convex, in lateral aspect much higher than the postscutellum, the latter vertical behind. *Postnotum long,* as long as the postscutellum, very finely transversely striate, with a longitudinal sulcus that is widened to a fovea. Propodeum (in lateral aspect) without horizontal part, very slightly convex and declivous, in the middle, like the thorax, very finely granulated, and with conspicuous silvery white decumbent pubescence laterally and posteriorly. 1st abdominal segment 1.5 times as long as broad, conical; tergite VII yellowish, genital plate retracted, not visible. Wings with *small* pterostigma that is nearly quite dark; *cell m3 at its proximal lower angle not at all produced.* Basal vein curved below, vein Cut1 vertical, interstitial; veins Rt1 and Rt3 curved, 1st abscissa of R shorter than 2nd, 3rd as long as 1st (or shorter), 4th longer than anyone of the former; cell r3 below somewhat but little shorter than r2, *the latter higher than long,* above almost only half as long as below; vein Mt3 ending in the middle of the cell r3; Cu of fore wing reaches apical margin almost fully. Vein Cut of hind wing only slightly curved, ending in a pointed angle, strongly prefurcal; basal portion of R 1.5 times as long as vein Rt3; Mt2 not quite vertical upon Cu; longitudinal veins of hind wing nearly reaching margin. Interior claw of fore tarsus shorter than the other, strongly curved, with stout pointed basal tooth, the claws of the middle and hind legs indistinctly dentate. Pulvillus slender. Apical tarsal joint without rows of spines on under side. Longer calcar of hind tibiae two-thirds to three-fourths of the length of the metatarsus. Spines on tibiae weak. Spines near apex of hind tibiae scarcely visible, almost decumbent, very small.

Habitat: 1 male, Abu Ghalib, 2.v.1952 (coll. Ein Shams University).

This species shows some resemblance to *Pseudagenia,* especially by the not pointed cell m3 of the fore wing and the comparatively weak tibial spines. It is not a true *Pompilus* anyway, but I am unable to place it definitely, the more as the female is still unknown. The species is named after Dr. Taher Sayed in recognition of his great interest in the insect survey of this country, that has resulted in a number of new discoveries like the above.

Genus ANOSPILUS Haupt

(cf. Haupt, *Mitt. zool. Mus. Berlin,* XV, 1929, p. 122; Haupt, *Boll. Ist. Ent. Univ. Bologna,* IX, 1937, pp. 87-93).

Like *Pompilus,* but the propodeum at the declivous portion somewhat flattened or slightly depressed, with median sulcus. *All tarsi shorter,* metatarsus of fore legs hardly as long as the three following joints combined. Comb bristles of the basal plate of the pulvillus stout. Tooth of claws of male obliquely directed backward. Cell sc rather broad, with comparatively steeply rising apical abscissa. Last tergite finely pilose or bare.

This genus is not well founded, the differences from *Pompilus* are rather slight ; it should better be treated as a subgenus.

Anospilus compactus spec. nov.

Female: 7.5-11 mm. — Head, thorax and propodeum black, abdomen ferruginous, the apical segments slightly darkened. Pubescence fine, pruinose, on the anterior part of the body greyish, on the abdomen yellowish grey. Coxae black, fore legs dark reddish, darker than middle and hind legs which are ferruginous, hind tibiae paler than middle tibiae, all with dark tips and dark tarsi ; the femora may be lined with black above. Antennae black, sometimes reddish beneath. Wings slightly shaded, more strongly so towards apex, with dark margin.

Head with orbits broadly emarginated at middle, eyes narrower than half of width of frons. Clypeus strongly transverse, scarcely emarginated in front for all its width. Frontal sulcus little pronounced. Position of ocelli obtusely angled. Distance of hind ocelli subequal to that between hind ocelli and eyes. Temples very short, in lateral aspect less than half as wide as the eye. Genae very short. Antenae short and stout, strongly involuted, joint 3 subequal to 1+2. Prothorax forming in lateral aspect a rounded obtuse angle: dorsally it is distinctly narrowed towards apex: the median sulcus is slightly indicated behind, the hind margin is obtusely emarginated, very slightly arched. Scutellum little convex, *postnotum short,* **scarcely** visible in the middle. Propodeum having the declivous **portion** about as long as the horizontal one, with very fine longitudinal sulcus and very indistinct transverse lines which are at most visible at the sides and posteriorly. Apex of abdomen scarcely pilose. Vein Cut1 interstitial, veins Rt1 and Rt3 curved, Rt2 vertical, slightly S-shaped, cell r2 above two-thirds as long as below, where it is subequal to r3, the latter above at most one-third as long as below, and therefore strongly narrowed towards fore margin. Vein Cut of hind wing not quite but almost vertical at apex, very slightly postfurcal; the longitudinal veins in the fore wing ending very far from apical margin. Legs stout and moderately long, the hind tarsi, though somewhat longer than the tibiae, much less so than in similar *Pompilus* species (cf. *P. arens*), about 2.3:3 mm.; longer terminal calcar of hind tibiae somewhat longer than half of the metatarsus. Terminal joint of hind tarsi bare on under side, without small spines. Claws moderately long, tooth small, behind middle, pulvillus longish, very small. Anterior metatarsus with *three* short comb spines, the last of which does not reach the apex of the 2nd tarsal joint and is shorter than the joint.

Male unknown.

From *A. similis* Haupt (Morocco, Tunisia, Algeria) differing in having abdominal segments I-III (-IV) ferruginous, and the head wholly black; from *A. bucculentus* Haupt (Palestine) by the same character, the concealed postnotum and the anteriolry convergent sides of the pronotum.

Habitat: The types (4 females) are from Kerdasa (vi.) and Fayed (v.), leg. H. Priesner; 1 female, Wadi Hof (v.), leg. Mochi.

Genus LEUCHIMON Haupt

1930. *Leuchimon* Haupt, *Mitt. zool. Mus. Berlin,* XVI. p. 792.

Clypeus not touching eyes, somewhat narrower than the lower face: *genae long.* Antennae moderately long, joint 2 elongate. Pronotum short. Scutellum flattened. Postnotum very short. Fore legs with *long* tarsal comb. Claws simple or with indistinct tooth. Fore wings with three cells r, cell r3 short (high) or short and petiolate. Vein Cut of hind wing (transverse anal vein) slightly S-shaped, prefurcal. Body with conspicuous decumbent (not pruinose) pubescence, the hairs of it comparatively large, sometimes with golden sheen. Propodeum longitudinally impressed posteriorly, at the sides with a few raised white hairs.

Key to the species

Females

1 (2) Cell r 3 petiolate .... **petiolatus spec. nov.**

2 (1) Cell r 3 not petiolate.

3 (4) Anterior metatarsus with *four* comb spines. .... **haupti spec. nov.**

4 (3) Anterior metatarsus with *five* comb spines.

5 (6) Tergites I-III ferruginous. Antennae black. Vein Cut1 of fore wing interstitial. Antennal joint 3 more than three times as long as broad.. .... **mochii nov. spec.**

6 (5) Tergites I-II ferruginous. Base of antennae ferruginous. Vein Cut1 of fore wing slightly postfurcal. Antennal joint 3 three times as long as broad (Cyrenaica) .... cf. *palmatus* Haupt

Leuchimon petiolatus spec. nov.

(Fig. 16)

Female: 5.5 mm. — Anterior body black beneath pubescence, only the hind margin of the pronotum reddish transparent. Abdomen ferruginous, tergite IV (and probably also the retraced segment V at base) darkened. Antennae black, legs ferruginous with basal half of fore femora, the whole fore tibiae and tarsi (except the paler metatarsus) black; middle and hind legs ferruginous, coxae, extreme base of femora, trochanters and tarsi (from apex of metatarsus) black, the metatarsi for the major part ferruginous. Wings hyaline, with sharply defined apical spot that enters the tip of cell sc. but does not reach the other cells. Palpi long, dark. Body very densely yellow-grey pubescent.

Head broad, distance of eyes below somewhat greater than above. Clypeus truncate in front, not reaching the eyes, genae long. Width of eye about half of frons; orbits little emarginated interiorly. Ocelli forming an obtuse angle, distance of hind ocelli greater (3:2) than that between hind ocelli and eyes. Temples, in lateral aspect, less than half as thick as the eye. Antennae stout, joint 3 scarcely longer than 1, the latter and joint 2 grey pubescent. Head much broader than the prothorax, the latter parallel-sided at least in posterior half, obtusely angled at hind margin. Scutellum rather flat. Postnotum very short, representing only a narrow, shining line. Propodeum short, parallel-sided, tapering only in posterior third, with a few raised white hairs near hind angles. Declivity about as long as anterior part, flattened. Vein Cut1 of fore wing interstitial; *cell r3 very small and slender (high), with long pedicel,* the latter occupying one-third to one-half of the hight of the cell; vein Rt2 broken; cell r2 above broader than r1. Rt3 of hind wing strongly oblique, about half of basal abscissa of R: Cut flat, strongly prefurcal. Cu of fore wing reaching margin. Anterior metatarsus with 3-5 (normally probably 4-5) long, yellow comb spines, the apical one being nearly twice as long as the 2nd tarsal joint, and nearly or fully reaching the apex of the 3rd joint. The longer calcar of the hind tibiae at least three-fourths of the length of the metatarsus. Claws simple, pulvillus small.

Habitat: Beni Youssef (15.iv.1926), leg. Alfieri.

Leuchimon haupti spec. nov.

Female: 6.5-7 mm. — Black, abdomen wholly ferruginous, or segments V and VI somewhat darkened at base. Legs ferruginous, coxae and trochanters black, fore tibiae at apex and fore femora blackened, or femora wholly red (f. *rufifemur* nov.). Tarsi black, calcaria dark. Wings hyaline at base, apex *broadly* blackened, the infumation mostly filling cell sc and cells r2 and r3; the extreme apical margin of the fore wing may be a little paler. The whole body densely clothed with grey to yellow-grey pubescence that has no metallic sheen. Antennal joint 1 sometimes ferruginous beneath.

Orbits slightly emarginated, the eye little narrower than half of frons. Genae conspicuous, clypeus not touching eyes. Ocelli forming an obtuse angle; distance of hind ocelli greater than that between hind ocelli and eye (3:2). Temples narrow. Antennal joint 3 subequal to 1. Antennae short and stout. Prothorax distinctly narrowed towards apex, sides nearly straight, hind margin shallowly emarginated. Scutellum sharp-edged, flattened, postnotum very short, barely visible. Propodeum parallel-sided, tapering in posterior third, slightly impressed posteriorly, with fine percurrent sulcus; pubescence on the horizontal portion obliquely directed backward, from middle. Cell sc higher than cells r; vein Rt1 strongly, Rt3 moderately curved, Rt2 almost straight; cell r3 much shorter than r2, strongly narrowed above, where it is only one-third to one-half as long as r2; vein Cut1 interstitial; Cu of fore wing almost reaching apical margin. Vein Rt3 of hind wing at most half as long as the basal abscissa of R; vein Cut very slightly curved, flat, prefurcal. Anterior metatarsus with *four* long comb spines, the 1st short, half as long as the 2nd, the apical one longer than the 2nd tarsal joint, reaching or somewhat surpassing the middle of the 3rd joint; one moderately long inferior comb spine present; the tibial calcar is about half as long as the metatarsus. Under side of apical tarsal joint of middle and hind legs with 2-3 pairs of very small spines. Tooth of claws vestigial, pulvillus small. Longer calcar of hind tibiae more than half as long as the metatarsus.

Male unknown.

Habitat: Marg, Fayoum (leg. Mochi); Kerdasa, Wadi El-Gobo (Min. Agric.); Abu Zabal (Alfieri); Kafr Hakeem (leg. Priesner).

Leuchimon mochii spec. nov.

(Fig. 17)

Female: 5.5-8.5 mm. — Ground of head and thorax black, abdomen ferruginous, base of segments IV and V darkened. Antennae black, mandibles yellow, *palpi black*. Legs ferruginous, fore tibiae and tarsi (towards apex) darkened, middle and hind calcaria pale, tips more or less blackened, comb spines of fore tarsi yellowish. Body clothed with dense yellowish pubescence that has a slight metallic sheen. Wings hyaline, with sharply defined blackish apical spot that enters somewhat cell sc; veins brownish. A few long raised pale hairs are present at the temples, the anterior sides of the prothorax and the posterior sides of the propodeum.

Head somewhat triangular in frontal aspect, orbits slightly converging towards vertex. The eye about as broad as half of frons. Temples, in lateral view, about one-fourth as thick as the eye. Palpi long. Antennal joint 3 a little longer than 1, somewhat shorter than 1+2. Ocelli forming a slightly obtuse angle. Prothorax slightly convex, parallel-sided posteriorly, sides convex and narrowed anteriorly, hind margin angularly emarginated. Notauli evenly incised. Scutellum flattened, slightly convex. Postnotum very short. Propodeum parallel-sided in front, narrowed in posterior third or more, short, declivity as long as horizontal part; sulcus conspicuous. Vein Rt1 strongly, Rt3 slightly curved, Rt2 straight; cell r3 small, almost triangular, and almost closed above, or only one-third to one-half as broad there as below; vein Cut1 interstitial or slightly postfurcal; Cu of fore wing reaching apical margin. Vein Rt3 of hind wing oblique, much shorter than basal abscissa of R; vein Cut strongly prefurcal. Metatarsus of fore leg with *five* yellowish, somewhat flattened comb spines of which the 1st one is short; perfect specimens have one inferior long comb spine about in the middle of the metatarsus; the last lateral comb spine is much longer than the 2nd tarsal joint; pulvillus small, comb bristles few, fine, short. Claws simple. Apical tarsal joint with about 2 pairs of very fine, short spines on the under side. Tibiae spinose (with 5-6 spines exteriorly and 3 spines interiorly).

Habitat: Pyramids of Giza (iii.), Gebel Asfar (iv.), leg. Alfieri, Mochi; Kerdassa (xi.), coll. Min. Agric.; Abu Roash (iii.), leg. H. Priesner.

Leuchimon griseoflavus spec. nov.

Male: 4.6 mm. — Body, antennae and legs black, only the knees and the apical hind margin of the hind femora reddish. The apical margins of the abdominal tergites reddish transparent. Body clothed with *very dense*, decumbent, coarse, yellow-grey pubescence, but on frons and clypeus with white pubescence that has a faint pinkish sheen; venter whitish-grey pubescent; on the propodeum the pubescence has also a metallic pinkish sheen when seen under higher magnification. Wings hyaline with for the major part dark veins of fore wing, pale veins of hind wing, and short apical darkening that reaches apex of cell sc, but not the cells r and m. Pterostigma yellowish.

Body shortly built. Frons not broader below than above, eyes very slightly emarginated, about half or little more as broad as the frons. Genae conspicuous, clypeus and mandibles not reaching the eyes; lateral margin of clypeus strongly converging anteriorly, fore margin broadly emarginated, fore angles obtuse. Mandibles yellow, tip reddish; base with white pubescence. Ocelli large, forming a slightly obtuse angle, (pol) longer than (ool). Temples short, laterally one-fifth to one-fourth of the eye, with only few raised white hairs. Antennae short and thick, joint 2 a little elongate, like the 1st joint about 1.5 times as long as broad, joint 3 comparatively short, somewhat shorter than 1, and none of the other joints as long as joint 1. Prothorax strongly narrowed towards apex, hind margin nearly angularly excavated; convexity of prothorax slight. Postnotum smooth, bare, with transverse striation at base, and shallow foveola posteriorly, somewhat shorter than the postscutellum. Propodeum convex, declivity about as long as the anterior portion, median sulcus feeble. Segment VII of abdomen *not* white. (Sternites retracted, not visible). Vein Cut1 of fore wing interstitial or slightly postfurcal; all veins Rt curved, Rt2 only slightly so; *cell r3 higher than long;* 1st abscissa of R a little shorter than 2nd, 3rd half as long (or less) than 2nd; cell r3 above about half as long as below, where it is much shorter than r2. Vein Cut of hind wing slightly S-shaped, joining Cu in a pointed angle, prefurcal. Longer calcar of hind tibiae about two-thirds as long as the metatarsus. Pulvillus small, claws simple. Interior claw of fore tarsus with stout blunt basal tooth.

Habitat: Beni Youssef, 24.iii.1935, leg. Mochi.

I should have put this male to *L. mochii,* if it had not a *bare, black postnotum* so that we have to anticipate that it belongs to a yet unknown female showing the same character. It can hardly be assumed that the sexes differ in the pubescence of the postnotum.

Genus EVAGETES Lep.

1927 *Evagetes* Haupt, Mon. Psamm. Europas, *D. Ent. Zeitschr.*, p. 227.
1930. *Evagetes* + *Tachyagetes* Haupt, *Mitt. zool. Mus. Berlin,* XVI, p. 690.

Exactly like *Pompilus,* but with two radial cells instead of three.

Key to subgenera

1 (4) Postnotum very short, scarcely visible behind postscutellum, bare. Pulvillus very small.

2 (3) Body covered with pruinose pubescence, ground partly visible. Antennae stout, joint 3 as long as 1. Genae short. Fore wings not

with sharply defined dark apical spot. (typ. *dubius* Lind.) .... **cf. Subgenus Evagetes s. str.**

3 (2) Body with dense decumbent pubescence covering the ground. Antennae normal, joint 3 equalling 1+2. Long spur of middle tibiae about as long as metatarsus. Genae long. (typ. *genalis* nov.) .... **Subgenus Epagetes nov.**

4 (1) Postnotum long.

5 (8) Body with dense decumbent pubescence, ground scarcely visible.

6 (7) Pubescence of postnotum as dense as that of the propodeum. (typ. *sericeus* Spin.) .... **Subgenus Dasyagetes nov.**

7 (6) Postnotum bare, black. (typ. *deserticus* nov.) .... **Subgenus Exagetes nov.**

8 (5) Pubescence fine, pruinose, shorter, also on the propodeum so, ground more or less distinctly visible. Postnotum bare or only laterally slightly pubescent. (typ. *filicornis* Tourn.) .... **Subgenus Tachyagetes Haupt**

Subgenus Tachyagetes Haupt

1 (6) Ground of body wholly black.

2 (3) Cell r2 almost closed above (Fig. 20). .... **rarus spec. nov.**

3 (2) Cell r2 broadly open above.

4 (5) Rt1 of fore wing straight (Fig. 19). Basalis straight, joining Cu in a pointed angle. Apical tarsal joint beneath without small spines, bare. Length 7.5-8.5 mm. .... **arabicus spec. nov.**

5 (4) Rt1 of fore wing curved (Fig. 18). Basal vein curved, joining Cu in a right angle. Apical tarsal joint on under side with a pair of vestigial spines. Length 5.5-8 mm. .... **pharaonum (Kohl)**

6 (1) Abdomen partly or wholly red or ferruginous.

7 (8) Cell r2 narrow above, as long as or shorter than 1st abscissa of R. Wings distinctly shaded, with dark apex. .. **aegyptiacus spec. nov.**

8 (7) Cell r2 broader above, at least somewhat longer than 1st abscissa of R.

9 (14) Comb of fore tarsi well developed, comb spines much longer than apical width of metatarsus.

10 (13) Propodeum without distinct median sulcus. Postnotum bare. Pubescence only pruinose, the finely granulated ground visible everywhere.

11 (12) Apical tarsal joint without inferior spines. Basal vein slightly curved. 2nd abscissa of R much longer than 1st. Inner orbits slightly convergent below. Comb spines somewhat longer, dark. **sericans (Klug)**

12 (11) Apical tarsal joint with three pairs of very fine spines on the under

side. Basal vein straight. 1st and 2nd abscissa of R subequal. Orbits diverging to vertex rather than otherwise, eyes more distinctly emarginated within. Comb spines shorter. .... **cahirensis spec. nov.**

13 (10) Propodeum with shallow median sulcus. Pubescence conspicuous, its elements on propodeum transversely arranged. Postnotum finely transversely pubescent, but hairs not fully covering the ground. Length 5.5 mm. .... **cf. Exagetes kerdasensis spec. nov.**

14 (9) Comb spines very short, shorter than apical width of metatarsus (Fig. 21). Propodeum with feeble median sulcus. Postnotum bare. .... **alter spec. nov.**

Tachyagetes pharaonum (Kohl)

(Fig. 18)

1812. Unnamed, Savigny, Descr. d'Egypte, pl. 18, fig. 17, female.
Pompilus pharaonum Kohl, in schedis.

Female: 5.5-8 mm. — Black, dull, with fine pruinose grey pubescence, the ground visible. Mandibles red in the middle, legs and antennae black. Head in front densely clothed with silvery adpressed pubescence, less densely the temples, the prothorax at the sides, least dense the coxae and disk of pronotum. Head above with *sparingly set* raised blackish hairs, and the propodeum with some grey raised hairs near the posterior angles. Wings hyaline at base, broadly and strongly shaded at apex, hind wings hyaline, at apex mostly slightly shaded.

Head about triangular in frontal aspect; eye as broad as half of frons; orbits below only slightly convex and little emarginated above. Ocelli forming a right or very slightly obtuse angle, pol:ool=4:3. Genae short, clypeus not fully touching eyes, but distance very short; clypeus somewhat smoothened at fore margin, broadly truncate. Antennae slender, strongly involute, joint 3 subequal to 1 and 2 united or little longer, 4 distinctly shorter than 3. Temples (laterally) somewhat less than half as thick as the eye. Prothorax convex, angularly emarginated posteriorly. Notauli sharply incised. Scutellum flattened above, truncate apically. *Postnotum well as long as the postscutellum,* almost straight at hind margin, finely rugose, not striate, with deep median sulcus. Propodeum normal, *very finely granulated, wholly dull.* Abdomen slightly shining. Cell sc of fore wing a little lower than cells r, the latter having Rt1 and Rt2 *curved;* vein Mt3 very slightly prefurcal (to Rt2); Cut1 interstitial or very slightly postfurcal; Cu of fore and hind wing reaching margin. Rt3 of hind wing somewhat oblique, distinctly shorter than 1st abscissa of R; Cut of hind wing flat, strongly prefurcal. Anterior metatarsus with three black comb spines, the apical of which reaching the middle of the 2nd tarsal joint or slightly surpassing it; inferior comb spines wanting. Apical tarsal joint with 1 pair of *extremely minute* spines on the under side. Pulvillus truncate at apex, with two stouter comb spines, the others inconspicuous. Claws very finely dentate.

Male: 4.5-5.5 mm. — Coloration and venation as in the female. Rt3 of hind wing only little shorter than basal abscissa of R. Tergite VII ivory white. Genital plate semicircularly rounded at apex, margin set with extremely fine spines, under side with flat carina, raised hairs wanting.

Habitat: The species is fairly common in the desert valleys near Cairo (Wadi Umm-Assaad, Wadi El-Tih, Wadi Digla, Wadi Gerawi, Wadi Hof, but was also found at Abu Rawash, Kerdasa, Beni Youssef, Helwan, on the Suez Road and in the Fayoum, from Upper Egypt I saw it from the Wadi Assiouti. All the year round.

It can only be confused with the following species (*arabicus* nov. spec.), since *T. rarus* nov. spec. has cell r2 closed above, and vein Cu of fore wing does not reach the apical margin in this species.

Tachyagetes arabicus spec. nov.

(Fig. 19)

Female: 7.5-8.5 mm. — This species is so similar to *T. pharaonum* in habitus, colour and sculpture that a repetition of most of the characters seems to be superfluous. The differences consist particularly in the wing venation. In *T. arabicus* vein Rt1 is scarcely curved to straight, strongly oblique, Rt2 is distinctly curved. The basal vein is straight and joins Cu in a pointed angle. Vein Rt3 of hind wing is as long as the basal part (1st abscissa) of R, while it is less oblique and distinctly shorter than the last named part, in *T. pharaonum*. The head has fewer raised hairs. On the under side of the last tarsal joint there are no small spines present, whilst in *pharaonum* there is a rudimentary pair of such spines visible. The abdomen is more brownish than greyish pubescent. The species is larger, on an average.

I possess 7 specimens of this species which I held first to be a variety of *T. pharaonum*.

Male unknown.

Habitat: Wadi Hof (near Helouan) and Wadi Digla (near Meadi), ii., v.; and vi., leg. H. Priesner.

Tachyagetes haupti Guiglia

1941. *Tachyagetes haupti* Guiglia, *Ann. Mus. Stor. Nat. Genova,* LXI, p. 170, fig. IV.

Female: Wholly black, traces of ferruginous colour in the middle of the mandibles. The silvery white pubescence everywhere very fine and short.

Wings slightly infuscated with a broad dark apical band that fades out towards the apex of the wing, especially dark are pterostigma, C and Sc; the 2nd radial cell is broad in front, 2nd abscissa on R about 1.5 times as long as 1st (cf. fig. 2); vein Mt2 ending before middle of cell r2, vein Mt3 very slightly prefurcal; Cut of hind wing prefurcal. Head distinctly larger than the pronotum. Clypeus slightly convex, fore margin smooth, shining, almost straight. Orbits nearly parallel, distance of eyes on the vertex nearly equalling antennal joints 2 and 3 combined. (pol) subequal to (ool). Antennae slender, joint 4 as long as 1 and 2 combined, one-fifth shorter than 3. Hind margin of pronotum slightly angular at middle. Postnotum shining, as long as the scutellum. Anterior metatarsus with 3 comb spines, the apical one reaching middle of 2nd tarsal joint. Length not given in the original discription.

Habitat: Western Libya (iv.).

This species, unknown to me, has to come into the group of *pharaonum* Kohl and is, if one compares the wing figure given by Guiglia (fig. 2), closer to *arabicus* than to *pharaonum*. It differs from both in having the nervulus (Cut1) distinctly oblique, Mt3 closer to Rt2, almost interstitial, and in that the apical darkening of the fore wing fades out somewhat towards the margin, while it is uniformly dark in both, *pharaonum* and *arabicus*.

Tachyagetes rarus spec. nov.

Female: 8 mm. — Somewhat similar to T. *pharaonum* and *T. arabicus*, but at once distinguished by the closed 2nd radial cell and the small cell sc.

Black, legs reddish-black. Wings slightly shaded, with a darker shade along basal vein, apical margin of fore and (somewhat) hind wings blackish, the darkening nearly reaching the cells r and m. Frons below and at the sides; clypeus, labrum, temples, pronotum on front and at the sides, scutellum, at least laterally, postscutellum and propodeum with fine silvery pubescence. Frons, vertex, pronotal dorsum and scutum, propodeum in front dorsally and abdomen with fine brown pruinosity.

Clypeus nearly truncate in front, laterally touching the eyes. Genae very short. The eye little broader than half of frons. Ocelli forming a right angle. Vertex with only a few raised hairs (fewer than in *pharaonum*). Temples not quite half as thick as the eyes. Antennal joint 3 subequal to, or slightly longer than, joints 1 and 2 combined, 4 scarcely longer than 1. Pronotum deeply, nearly angularly, excavated at hind margin. Postnotum as long as postscutellum, deeper, transversely striate in the middle and bare, pubescent only at the extreme sides. Propodeum with deep median sulcus, without transverse wrinkles, the declivity with a slight roundish impression. Cell sc hardly half as large as cell r2; vein Rt1 very slightly, Rt2 sometimes more strongly curved, cell r2 almost or wholly closed above; vein Mt2 ending in 1st third of cell r2, Rt3 right in front of Rt2; Cu of fore wing ending far from apical margin; vein Cut1 (nervulus) almost interstitial or slightly postfurcal. 1st abscissa of R of hind wing hardly longer than Rt3; Cut of hind wing forming a slight arc, ending prefurcal. Anterior metatarsus with three comb spines the spical of which is a little more than half as long as the 2nd tarsal joint; inferior comb spines wanting. The under side of the last tarsal joint bears a double row of very fine spines. Claws distinctly dentate.

Male unknown.

Habitat: 3 specimens: Esbeth-el-Nakhl, 29.v.1913 (coll. Alfieri); Kerdasa, vii. (leg. Chakour, coll. Soc. Ent.); Cairo, 17. iv. (leg. and coll. Priesner).

Tachyagetes sericans (Klug)

1834. *Pompilus sericans* Klug, Symb. phys., pl. 39, fig. 11 (female).
1930. *Tachyagetes sericans* Haupt, *Mitt. zool. Mus. Berlin,* XVI, p. 703 (female).

Haupt has examined the type of this species (ex coll. Mus. Berlin), and has given the first comparative description. The abdomen of the type specimen he found missing, and thus erroneously Haupt ascribed to it a black coloured abdomen. He has obviously not seen either Klug's description or the illustration, from both of which it appears that the base of the abdomen is red.

Female: 7.5-9 mm. — Black, abdominal segments I-II (-III) red; antennae and legs black. Head in front with silvery pubescence. Raised pilosity present, especially on head (vertex), prothorax and at the temples; pubescence otherwise pruinose and comparatively scarce, so that the dark ground is visible everywhere. Wings slightly infumated, with broad apical darkening which is, however, not sharply defined. Pterostigma dark.

Temples, in dorsal aspect, rounded and scarcely parallel right behind eyes. Orbits slightly converging from clypeus towards vertex, emargination very slight; frons at the bottom slightly wider than on top; the eye little narrower than half of frons. Ocelli rectangularly placed, (pol)=(ool). Frons with fine median sulcus. Temples, in lateral aspect, almost only half as broad as the eye. Genae short. Antennal 3 longer than 1 and 2 combined, 4 as long as this combination. Clypeus strongly transverse, with straight fore margin. Pronotum hardly narrowed towards apex, with an obtusely angled emargination posteriorly. Scutellum and postscutellum flat, postnotum long, well as long as the postscutellum, with deep median sulcus. Propodeum comparatively short, moderately convex, without median sulcus. Cell r2 long, trapezoidal, with curved veins Rt; 1st abscissa of R about half as long as 2nd; cell r2 above somewhat more than one-third as long as below; basal vein distinctly curved for all its length; Cut1 little postfurcal. The 1st curved abscissa of R of hind wing distinctly longer than vein Rt3; Cut flat, sinuated, prefurcal. Fore tarsi with moderately long comb spines, metatarsus with three spines which are black and the last of which surpasses half of tarsal joint 2; apical tarsal joint without spines on the under side; pulvillus conspicuous, mostly bilobed; tooth of claws obliterated.

Male: 6-6.5 mm. — Abdominal segments I and II red as in the female, segment I with black longitudinal basal spot. Tergite VI margined with white posteriorly, tergite VII whitish. Basal vein of fore wing straight, nervulus interstitial. Postnotum scarcely shorter than postscutellum. Abdomen *slender,* longer than thorax (+propodeum). Genital plate flattened below, scarcely pilose, rounded at apex.

Habitat: The species was found at Borgash, Beni Youssef, Gebel Asfar, Cairo, Meadi, Maassara, Helouan, and Fayoum (i.-ix.).

Tachyagetes aegyptiacus spec. nov.

Female: 7.5 mm. — Black, inner orbits with faint yellow line in the excavation of the eyes. Abdominal segments I-III and base of the whole of segment IV ferruginous. 1st antennal joint, tibiae and tips of femora dark reddish. Comb of fore tarsi yellowish. Pubescence on frons, sides of prothorax and on coxae pale grey. Fore wing shaded with pale brown for all its length, with little defined dark apical margin that enters somewhat cell sc, but does not reach the other cells.

Eyes distinctly emarginated within, one eye scarcely narrower than half of frons. Position of ocelli rectangular, (pol) subequal (ool). Head strongly narrowed behind eyes, much less convex than in *filicornis* Tourn. Temples, in lateral aspect, about half as broad as the eye. Clypeus straight in front. Antennal joint 3 as long as 1+2. Prothorax at hind margin obtusely excavated. Postnotum transversely striate, with central foveola, shorter than but more than half as long as the postscutellum. Propodeum with fine median sulcus. Wings having vein Cut1 distinctly postfurcal; cell r2 triangular, as a whole, but its upper margin somewhat longer than in *T. excellens* Hpt., only little less than one-third of the hind margin; 1st abscissa of R as long as 2nd, about one-third of 3rd; vein Mt3 distinctly prefurcal; vein Rt1 *straight,* but strongly oblique. Rt3 of hind wing a little longer than the basal portion of R; vein Cut strongly prefurcal, ending by a pointed angle. The longer calcar of the hind tibiae little longer than half of metatarsus. Under side of the terminal joint of the hind tarsi with a double row of very weak spines. Pulvillus well developed but small, claws long, tooth conspicuous, vertical. Anterior metatarsus with three comb spines which are distinctly somewhat longer than the apical width of the metatarsus, the apical comb spines reaching about the middle of the 2nd tarsal joint; an inconspicuous lower comb spine may be seen on the middle of the under side.

Habitat: 1 female, Helouan, 20.x.1934, leg. H. Priesner.

Tachyagetes cahirensis spec. nov.

Female: 7.5 mm. — Black, the first three abdominal segments red. Antennae and legs black, femora and tibiae dusky reddish transparent. Head with silvery white, clypeus in front with more brownish, pubescence. Raised hairs extremely scarce. Wings slightly shaded, with broad apical darkening that does not quite reach the cells r and m but slightly enters cell sc.

Orbits below nearly parallel, but slightly divergent towards middle of frons, the emargination more conspicuous than in *sericans* (Kl.); frontal sulcus only slightly indicated above antennal cavities. Position of ocelli rectangular, (pol) subequal (ool). Temples, in dorsal aspect, strongly rounded, though even right behind eyes not parallel, somewhat less thick than in *filicornis* (Tourn.); in lateral aspect the temples are more than half as thick as the eye. Genae short. Antennal joint 3 as long as 1 and 2 combined, 4 slightly longer than 1. Clypeus with fore margin straight. Prothorax as in *T. sericans*. Postnotum as long as postscutellum, with fine and smooth longitudinal sulcus. Cells sc, r2 and the pterostigma are shorter than in *sericans;* 1st and 2nd abscissa of R subequal in length, 3rd more than twice as long; cell r2 above scarcely one-third as long as below; veins Rt little curved; vein Mt3 very slightly prefurcal; Cut1 distinctly postfurcal; basal vein straight, perhaps only at extreme base slightly curved. Hind wing as in *T. sericans*, but vein Rt3 distinctly longer than the basal portion of R. Anterior metatarsus with three *very short, yellowish* comb spines which are only somewhat longer than the apical width of the metatarsus, the last spine nearly or wholly reaching the middle of the 2nd tarsal joint; an equally small lower comb spine (of under side) is visible behind middle, but may be easily overlooked. Hind tarsi with three pairs of very fine small spines on the under side (in *sericans* such spines are wanting). Claws distinctly dentate, pulvillus about as in *sericans*.

Male unknown.

Habitat: 1 female, Marg, 13.iv.1938, leg. H. Priesner.

This species is extremely similar to *T. sericans*, but specifically differing by several characters, as indicated in the description and key. From *T. excellens* Haupt (Tunisia) it is distinguished by the non-triangular cell r2, the narrower dark apical margin of the fore wing, the convex temples; from *T. differens* Haupt (Cyrenaica) by the darker legs, the dorsally brownish pubescent thorax, the more strongly convex temples and the slightly longer comb spines of the anterior metatarsus. From *T. alter* (see below) the above species differs by the longer comb spines, the darker, stouter legs, the not so distinctly curved vein Rt1 of the fore wing, and the longer vein Rt3 of the hind wing.

Tachyagetes alter spec. nov.

(Fig. 21)

Female: 6.5-7.5 mm. — Close to *T. sericans* (Kl.) and *T. differens* Hpt. Black, abdominal segments I-III red, rest black. Legs dusky red, with blackened coxae and somewhat blackened femora (especially at base) and apices of tarsi. Frons below at the sides and clypeus with decumbent whitish pubescence, as well as the temples and coxae below; the propodeum, but less distinctly, white-grey pubescent. The *very short* comb spines of the fore metatarsus ferruginous. Antennae dusky reddish-black. Clypeus in front, and mandibles ferruginous. A small yellowish spot or line in the excavation of the eyes. The middle of the pronotal collar margined with yellow-brown. Tegulae testaceous. Wings scarcely or slightly shaded, apex dark to the cells.

Clypeus reaching eyes. Frons somewhat shining, sulcus visible, inner orbits parallel below or nearly so, slightly emarginated right above middle. Ocelli forming a right angle, (pol)=(ool). Temples (laterally) half as wide as the eye or a little more. Antennal joint 3 well as long as 1 and 2 combined, 4 as long as 1. Prothorax strongly transverse, angularly excavated behind. Postnotum somewhat shorter than the postscutellum, transversely striate, with fine median sulcus, for the major part bare, pubescent only at the sides. Propodeum normally convex, finely sculptured, with fine median sulcus. Vein Cut1 somewhat curved, very slightly postfurcal; Cu does not quite reach the apical margin; cell r2 above one-third to one-half as long as below; *vein Rt1 curved in the middle, Rt2 curved at base,* cell r2 trapezoidal; 2nd abscissa of R as long as or distinctly longer than 1st; vein Rt3 interstitial or distinctly prefurcal. Vein Rt3 of hind wing little shorter than basal portion of R; Cut forming a flat arc at apex, and a pointed angle with Cu, prefurcal; also Mt2 not vertical upon Cu. Fore tarsi with extremely short comb spines, which are distinctly shorter than the apical width of the metatarsus. Apical joint of hind tarsi bare, without double row of small spines on under side. Tooth of claws small; comb bristles of pulvillus weak.

Male unknown.

Habitat: 2 females, Abu Rowash, Helouan (viii., ix.), leg. H. Priesner.

The species seems to come very close to *T. differens* Hpt. (Cyrenaica), but is, as to my opinion, specifically different by the rectangular position of the ocelli, the ferruginous inner orbits, and shorter, practically vestigial comb spines of the anterior metatarsus.

Subgenus Dasyagetes nov.

Key to Egptian species

1 (6) Females.

2 (5) Genae well developed.

3 (4) Body and legs with pale raised hairs; pubescence of propodeum (and other parts) with slight reddish metallic sheen. Wing veins for the major part pale yellowish. .... **indutus (Kohl)**

4 (3) Body and legs without raised hairs. Pubescence grey to yellow grey, but not with metallic sheen. Veins mostly dark. .... **secretus spec. nov.**

5 (2) Genae very short. Thorax, propodeum and legs without raised pilosity; pubescence of propodeum (and other parts) without metallic sheen. Veins for the major part brown. Common species. .... **sericeus (Spin).**

6 (1) Males.

7 (10) Genae well developed. Femora partly blackened.

8 (9) Antennal joint 3 about twice as long as 2. Dark apical spot of wing reaching R. .... **secretus spec. nov.**

9 (8) Antennal joint 3 only 1.5 times as long as 2. Apical spot of fore wing not quite attaining R. .... **indutus (Kohl)**

10 (7) Genae very short. Femora and tibiae ferruginous. **sericeus (Spin.)**

Dasyagetes sericeus (Spinola)

1838. *Aporus sericeus* Spinola, *Ann. Soc. Ent. France,* VII, p. 462.
1897. *Pompilus sericatus* Dalla Torre, Catal. Hym., VIII.

« *Aporus sericeus* n. sp. Female. Long. 3 lig. Larg. 2/3 lig. Antennes noires. Mandibules testacées. Palpes et autres organes manducatoires noirs. Tête, corselet et hanches noirs, et couvert d'un duvet cendré très-court et très serré, qui les fait paraître presque pulvérulents. Abdomen et pattes rouges, couverts d'un duvet plus court, plus fin, presque unicolore, qui les fait paraître seulement ternes et d'une teinte un peu plus claire. Extrémité des tarses noire. Ailes hyalines; une tache noire brusquement tranchée, à l'extrémité des supérieures; nervures obscures. »

Female: 7-9 mm. — Anterior body black on the ground, the extreme sides of the pronotum mostly ferruginous, coxae black, tips often pale, femora and tibiae ferruginous, tarsi dark, metatarsi ferruginous at base. Antennal joint 1 sometimes pale at tip beneath. Wings hyaline, with sharply defined black apical spot that may partly shade cell sc, but does not touch the other cells; in the cell r2 sometimes a grey longitudinal shade. Mandibles yellowish. The whole body clothed with dense, hair-like ochrous to grey decumbent pubescence that is finer on the abdomen than on the thorax, but has never any metallic sheen. Vertex with very few dark raised hairs.

The anteriorly brownish clypeus nearly reaches the eyes. Genae present, but short. Palpi long, darkened. Frons below somewhat but little broader than above, orbits not noticeably emarginated, somewhat convergent below. The eye is about subequal in width to half of frons or little broader. Ocelli forming an indistinctly obtuse, nearly right angle, (pol) scarcely longer than (ool). Temples, in lateral aspect, widened towards mandibles, below more, above less than half as wide as the eye; with only moderately long raised white hairs. Antennae slender, joint 3 longer than 1 and 2 united, 2 somewhat longer than thick. Pronotum slightly narrowed towards apex, hind margin deeply angular in the middle. Scutellum scarcely convex, without sharp lateral edges; postscutellum flat, *postnotum about as long as the postscutellum, pubescent,* with bare longitudinal foveola in the middle. Propodeum normal. Pterostigma narrow; basal vein curved below, vertical upon Cu, the upper part short; Cut1 interstitial; cell sc much lower than r2; both veins Rt *curved,* 2nd abscissa of R as long as 1st, 3rd not twice as long as 2nd; Cu of fore wing almost or wholly reaches apical margin. Rt3 of hind wing somewhat shorter than basal part of R; Cut flat apically, distinctly prefurcal. Anterior metatarsus with three short black comb spines, the last of which surpassing the middle of the 2nd tarsal joint but not reaching its apex; an inferior comb spine is only present at extreme apex. The rows of spines on the under side of the apical tarsal joint are present but very small. Pulvillus *large,* basal plate with few but conspicuous fine comb bristles. Claws with small tooth.

Male: 5.5-6 mm. — Coloration as in the female, but red are sometimes only the first three abdominal segments and segment VII, while IV-VI are black, with more or less ferruginous hind margin. Antennal joint 1 subequal to 3, joint 4 little longer, 2 half as long (or somewhat more) as 3, about half as long as 4, only in certain directions somewhat longer than broad. Genae as in the female, i.e. shorter than in *indutus* from which it differs, besides, by the paler femora which are darker at most at extreme base, by the darker wing veins and the longer antennal 3 which is in *indutus* only 1.5 times as long as joint 2; moreover, in *sericeus* the propodeum is scarcely sulcate. The head bears on the vertex only a few raised white hairs. Antennae black, joint 1 and 2 grey pubescent. Trochanters and fore tibiae (exteriorly) somewhat brownish. Wings slightly milky, opalescent.

Tachyagetes sericeus Haupt (*Mitt. zool. Mus. Berlin,* XVI, 1939, p. 698) is certainly not identical with the Egyptian species described above, since in Haupt's species (from Biskra, Algeria) the comb spines are scarcely longer than the apical width of the metatarsus and the postnotum is smooth and bare.

Habitat: The species is one of the most common *Pompilidae* of this country and especially characteristical to the desert valleys. Localities: Borgash, Kerdasa, Pyramids of Giza, Sakkara; Meadi, Wadi Digla, Wadi El-Tih, Wadi Hof, Wadi Gerawi, Wadi El-Gobo, Bir Odeibât, Wadi Assiouti; Fayed. In the collections of the Ministry of Agriculture, Alfieri and Priesner (iii.-viii.).

Dasyagetes secretus spec. nov.

Female: 5.5 mm. — Black, the whole body covered with yellowish grey decumbent pubescence that is finer than in the following species, on the abdomen it is pruinose. Abdomen ferruginous, segment III with blackish transverse fascia, the following segments black, margined with yellow, segment VI ferruginous. Antennae black, mandibles ferruginous, fore and middle legs black with reddish knees, hind legs with femora ferruginous in apical half or at apex only, and tibiae ferruginous, and blackened at tips; tarsi black. Wings hyaline, with dark apical spot that only reaches cell sc. Veins darkened.

Head, in frontal aspect, forming a spherical triangle; eye somewhat narrower than half of frons between them. *Genae distinctly developed,* distance of eyes from the mandibles not quite as long as antennal joint 2. Clypeus far apart from eyes. Frons below somewhat broader than above. Eyes within scarcely noticeably emarginated. Ocelli forming about a right angle, (pol) equalling (ool). Temples, in lateral aspect, thick, somewhat more than half as broad as the eye. Antennal 3 longer than 1 and 2 combined. Prothorax nearly obtusely angled at hind margin. Scutellum and postscutellum flat, postnotum nearly as long as the postscutellum, with dense, decumbent, transversely posited pubescence. Propodeum slightly convex, with broad and shallow median sulcus. Abdomen shorter than thorax (+ propodeum), less elongate than in *indutus.* Vein Cut1 interstitial; Cu of fore wing reaching margin; cell r2 *shortly trapezoidal,* veins Rt1 and Rt2 curved. 1st abscissa of R shorter than 2nd, the latter half as long as 3rd; cell r2 above less than half as long as below. Cut of hind wing flatly curved, slightly sinuated, joining Cu in a pointed angle, prefurcal; Rt3 scarcely shorter than the basal abscissa of R. Anterior metatarsus with three dark comb spines the apical of which is almost as long as, or little shorter than, the 2nd tarsal joint; inferior comb spines wanting. There may be 1 or 2 pairs of vestigial spines present on the under side of the apical tarsal joint.

Pulvillus well developed, bilobed. Claws not dentate.

Male: 4.5-5 mm. — Body anteriorly black, abdominal segments I and II ferruginous, the posterior segments more or less blackened, with reddish posterior margins, tergite VII yellow. Antennae black, fore and middle legs almost wholly dark, only the knees pale, hind legs having base of femora black, tibiae darkened towards apex, tarsi almost wholly dark. Veins yellowish at base, for the major part dark at apex.

Antennal joint 3 twice to more than twice as long as 2, joint 4 about as long as 3. Body anteriorly moderately densely pubescent, joints 1 and 2 also with grey pubescence. Genae well developed, at least as long as antennal 2. Prothorax obtusely angled at hind margin. Postnotum about as long as postscutellum, everywhere (excepting median sulcus) with transverse grey pubescence. Pubescence without metallic sheen. Basal vein of fore wing curved, at base vertical upon Cu; 1st abscissa of R about one-half as long as 2nd; vein Mt3 ending distinctly proximal to Rt2. Vertex above with a few raised whitish hairs.

I collected 6 males of this type which agrees with the above described unique female in the venation and most other characters.

Habitat: 1 female, Kerdasa, 23.ii.1936; 6 males, Wadi El-Tih (iv.); Fayed (leg. H. Priesner).

Dasyagetes indutus (Kohl)

(*Pompilus indutus* Kohl, in schedis)

Female: 6-8 mm. — Anterior body black on the ground, segments I and II of abdomen ferruginous, middle of base of tergite I and apex of abdomen dark, hind margins of segments ferruginous. Pubescence dense, wholly covering the ground, grey to yellow-grey, with a greenish golden sheen, especially on the propodeum; besides, the body is set with whitish raised hairs, e.g. on the vertex, the temples, the pronotum, propodeum (laterally and posteriorly), on the base of the 1st abdominal tergite, the sides of the apical segments, and more or less densely also on legs and coxae. Mandibles yellow, palpi dark, antennae black. Fore legs black, knees and at least base of metatarsus ferruginous, hind coxae and femora dark, tibiae and calcaria ferruginous, middle tibiae sometimes slightly shaded, middle and hind tarsi darkened towards apex. Wings pale, somewhat milky white, with brownish veins that are darker towards apex, and with sharply defined black apical spot that reaches cell sc, and often darkens its apical half.

Clypeus about four times as wide as long, anteriorly emarginated in a shallow arc, not reaching eyes laterally. Genae long. Palpi long and slender. Antennal joint 3 subequal to 1. Ocelli forming a right angle, (pol) scarcely longer than (ool). Temples, in lateral aspect, about half as thick as the eye. Eye about half as broad as frons. Pronotum flattened, hind margin angular, length scarcely half of width. Notauli fine, evenly incised, scutellum flat above. Postnotum long, not black, pubescent everywhere. Propodeum parallel-sided at base, slightly tapering from middle to apex. Cell r2 broad above, but less than half as broad as below; veins Rt slightly curved; Mt3 slightly S-shaped; Cu attaining margin; Rt3 of hind wing somewhat longer than the basal portion of R; vein Cut strongly prefurcal. Fore tarsi stout, moderately long, with three moderately long yellow comb spines, the third of which being about as long as the 2nd tarsal joint; inferior comb spines wanting. Apical tarsal joint without under side spines. Claws simple. Pulvillus large, bilobed, plate with about 6 comb bristles surpassing the pulvillus.

Male: 5.5 mm. — Like the female with very dense decumbent pale pubescence, but the raised pubescence is only at the prosternum and the temples conspicuous. Ground of anterior body black, abdominal segments red transparent through the dense pubescence, base of segments blackened. Antennae black, legs ferruginous, coxae and femora black, the latter in apical half or at tips ferruginous; tarsi black, metatarsi ferruginous at base. Wings as in the female. Pulvillus slender, but well half as long as claws. Abdomen moderately long. Postnotum nearly as long as the postscutellum, with decumbent pubescence. Genae conspicuous. Antennal 1 densely white pubescent.

Differing from the male of *sericeus* by the darker femora, the long genae, the longer 2nd antennal joint and the shorter cell r2 which is not longer above than the 1st abscissa of R.

Habitat: Not rare and was found almost all the year round at the following localities: Abu Rowash, Kerdasa, Pyramids of Giza, Marg, Gebel Asfar, Suez Road, Wadi Umm Assaad, Wadi Hof and in the Fayoum.

I have adopted the name *indutus* for this species, since I found a perfect specimen in the collection of the Museum of Vienna, which was labelled by Kohl as « *Pompilus indutus*-Type ». The specimen was taken by H. Rolle at the Pyramids of Giza, in December.

Subgenus Exagetes nov.

1 (4) Females.

2 (3) Comb spines of fore tarsi somewhat longer, apical spine of metatarsus at least reaching middle of 2nd tarsal joint. Vein Rt1 of fore wing almost broken; 2nd abscissa of R shorter than 1st; cell r2 almost closed. Pubescence of propodeum shorter, obliquely directed backward in the middle. .... **mosis spec. nov.**

3 (2) Comb spines shorter. Vein Rt1 scarcely curved; 2nd abscissa of R as

long as or longer than 1st. Pubescence of propodeum longer, silky, transversely posited in the middle. .... **deserticus spec. nov.**

4 (1) Males.

5 (6) Body and legs wholly black beneath pubescence. Abdomen slender. .... **cinerellus spec. nov.**

6 (5) Abdominal segments I-III, femora and tibiae ferruginous. .... **deserticus spec. nov.**

Exagetes mosis spec. nov.

Female: 7.5 mm. — Head and tibiae black, antennae black, legs more or less dusky red, coxae dark, tips red, tarsi black. Abdomen wholly ferruginous, the two apical segments may be slightly darkened. Wings hyaline, anterior pair with sharply defined dark apical spot which only enters somewhat cell sc. Head, thorax, propodeum and coxae densely clothed with grey pubescence, temples and frons more whitish pubescent, only the temples with some erect hairs.

The eye somewhat narrower than half of frons, median sulcus of frons conspicuous. Temples, in lateral aspect, somewhat more than half as broad as the eye. Ocelli forming a pointed angle, (pol) = (ool). Eyes within only slightly emarginated. Clypeus anteriorly very slightly emarginated for all its width, densely pubescent. Antennal 3 as long as 1+2. Prothorax scarcely convex, sides nearly parallel, hind margin excavated and forming an obtuse angle. Scutellum and postscutellum flat. *Postnotum bare, black,* finely transversely striate, in the middle more than half as long as the postscutellum, with median foveola. Propodeal sulcus inconspicuous. Basal vein straight Cut1 *distinctly* postfurcal; vein Rt1 strongly curved, Rt2 straight, oblique; 1st abscissa of R much longer than 2nd; cell r2 above about one-fourth as long as below; cell sc short; Cu not reaching margin. R of hind wing curved at base, Rt3 little differing in length from basal part of R; Cut of hind wing somewhat curved, strongly prefurcal. Anterior metatarsus with three short yellow comb spines the last of which being more than half as long as tarsal joint 2; inferior comb spines wanting. Under side of apical tarsal joint without row of small spines. Pulvillus conspicuous, moderately long, slender. Claws with small tooth. The long calcar of the hind tibiae pale, longer than half of the metatarsus.

Habitat: Sinai (v.), leg H. Priesner.

Exagetes deserticus spec. nov.

Female: 6.5 mm. — Head and thorax black, hind margin of pronotum (if always?) narrowly reddened; coxae black, tips red, femora, tibiae, metatarsi and 1st antennal joint (below), and the whole abdomen ferruginous.

Clypeus and pronotal collar narrowly margined with testaceous. Wings hyaline, with slight milky opacity, and with sharply defined black apical spot which reaches tip of cell sc, but remains distant from the other cells for about their length. The whole body is covered with silky pubescence that has a silvery sheen on the head and the sides of the body. Veins brown, Sc blackish, pterostigma pale brown.

Head, in frontal aspect, strongly transverse, the eye somewhat narrower than half of frons, orbits scarcely emarginated within, a fine frontal sulcus visible. Genae developed, but moderately long, about as long as antennal 2. Temples narrowed posteriorly, but rather convex; distinctly more than half as thick as the eye, in lateral aspect. Clypeus straight in front, truncate. Ocelli in rectangular position, (pol) shorter than (ool). Antennal 3 little longer than 1 and 2 combined. Prothorax little convex, little narrowed towards apex, obtusely excavated at hind margin. Postnotum bare, black, somewhat shorter than the postscutellum, without a distinct sulcus. Propodeum with conspicuous very fine median sulcus, the silvery pubescence transversely directed. Basal vein of fore wing straight, Cut1 interstitial; *veins Rt straight,* only Rt2 slightly curved at extreme base; 2nd abscissa of R as long as or scarcely longer than 1st; cell r2 above more than one-third or less as long as below; Mt3 almost interstitial, scarcely prefurcal; Cu of fore wing attaining the margin. R of hind wing curved at base, basal abscissa about as long as Rt3. In the hind wing Cut forming with analis an obtuse angle, being only slightly curved and strongly prefurcal. Fore tarsi with three short comb spines the apical one being longer than the distal width of the metatarsus, and less than half as long as the 2nd tarsal joint: inferior comb spines wanting. Pulvillus slender, moderately long; claws not distinctly dentate. The longer calcar of the hind tibiae is at most half as long as the metatarsus.

Male : 5.5-6 mm. — The male, as to my opinion belonging to the female just described, is of the same coloration. Body more densely covered with grey pubescence. The abdomen has the three apical segments (except their hind margins) more or less darkened; coxae dark at base. Venation exactly as in the female, Cut of hind wing may be slightly sinuated (S-shaped). Postnotum black, not pubescent. Antennal 3 about three times as long as 2, joints 1 and 2 with grey pubescence, the other joints black. Genital plate with obliquely raised black hairs.

Habitat : 1 female, 4 males, Pyramids of Giza, Wadi El-Tih, Kerdasa (leg. H. Priesner); Wadi Assiouti (Min. Agric.), from iv. to viii.

The male of this species is at first sight habitually similar to that of *sericeus* (Spin.), but differs by the bare, black postnotum and the anteriorly much narrower cell r2 of the fore wing.

Exagetes cinerellus spec. nov.

Male: 5-6.5 mm. — Body, antennae and legs black. Head, thorax and abdomen, 1st antennal joint and legs with dense and fine grey pubescence, but tergites V and VI of abdomen with brown pubescence, VIII ivory white, but sometimes retracted. Wings hyaline, fore wings with broad, dark apical margin which is rather straight within, and reaches cell sc but not the other cells.

Outline of head about triangular. Clypeus broad, almost reaching apex of eyes. Genae short. Eyes slightly emarginated within, a little broader than half of frons. Ocelli in nearly rectangular position, (pol) = (ool). Temples less than half as thick as the eye. Head on the vertex sparingly set with short black hairs. Antennae slender, moderately long, joint 3 scarcely longer than 1 exteriorly, shorter than 1 interiorly, 2 as long as broad, 3 twice as long as broad, shorter than 4. Prothorax narrowed anteriorly, with very dense whitish grey pubescence, hind margin angular. Scutellum convex. *Postnotum slightly longer than the postscutellum,* slightly rounded at hind margin, very finely transversely striate, with deep median sulcus, black, bare, and therefore much contrasting from postscutellum and propodeum. Propodeum at base parallel-sided only for one-fourth or one-third of its length, then tapering towards apex, pubescence dense, ground sculpture not visible; sulcus as continuation of that of the postnotum visible at base. Abdomen *slender,* somewhat longer than thorax (+propodeum); pubescence, though hair-like, finer than on the propodeum. Fore wings with basalis straight, radial veins curved; Mt3 somewhat prefurcal, Mt2 ending proximal to middle of cell r2; cell r2 below shorter than r1, above only one-fifth to one fourth as long as below; 1st and 2nd abscissa of R subequal, short, only about one-third of 3rd abscissa; pterostigma small, dark; cell sc smaller than cell r2, only about half as high as the latter; Cut1 distinctly somewhat postfurcal; Cu of fore wing not reaching margin. Rt3 of hind wing almost longer than basal abscissa of R; Cut forming a flat arc and being slightly prefurcal. Longer calcar of hind tibiae more than half as long as the metatarsus; apical tarsal joint without spines on the under side. Tooth of claws very weak; pulvillus slender, about half as long as claws.

Habitat: Wadi Hof (iii. and x.), leg. Mochi and Rabinovitch; Wadi Digla (iv.), leg. Priesner.

The very dense pubescence of this form excludes the possibility that it represents the male of *T. arabicus.*

Subgenus Epagetes nov.

Epagetes genalis spec. nov. (Figs. 23 and 24)

Female: 7.5-8 mm. — Anterior body black, hind margin of pronotum sometimes reddish transparent; abdomen ferruginous, tergite V dark owing to its brown pubescence. Legs, inclusive of coxae, ferruginous, tarsi and fore tibiae, the latter exteriorly and apically, dark. Palpi and mandibles testaceous. Antennae black, joint 1 ferruginous. Wings hyaline, with broad black apical spot that reaches cell sc but not quite cells r and m.

Anterior body very densely clothed with greyish yellow pubescence so that the ground is not visible; the grey pubescence of the abdomen is a little denser towards the hind margins, tergite V with dark brown pubescence, that of tergite VI has a more golden brown sheen. Antennae moderately long, joint 3 about as long as 1+2. Orbits only very slightly emarginated. Eye a little less than half as wide as frons. Ocelli forming an obtuse angle. Genae decidedly long, distinctly longer than antennal 2. Clypeus narrower than frons, rounded in front, not twice as broad as long. Temples narrow. Palpi long. Prothorax narrowed towards apex, deeply almost angularly, emarginated posteriorly. Notauli more strongly incised posteriorly, sides of scutum very slightly raised behind. Scutellum convex, densely pubescent. Postnotum bare, *very short*, linear in the middle. Propodeum parallel-sided in basal two-thirds (or less), median sulcus conspicuous. Sides of the apical sternites with a few dark setae. *Cell sc small;* vein Rt1 slightly curved below, Rt2 straight: cell r2 narrow above, only one-third as long as below: vein Mt3 very close to Rt2, but not interstitial; Cut1 interstitial, a little oblique; Cu ending far from apical margin. Vein Rt3 of hind wing oblique, subequal to basal abscissa of R: vein Cut forming a shallow arc, prefurcal. Fore tarsi with very long comb spines that are yellow and somewhat lanceolate; 1st metatarsus with three lateral comb spines the apical one of which reaching at least the middle of the 3rd tarsal joint, and is more than 1.5 times as long as the 2nd tarsal joint: besides, the 1st metatarsus has *two inferior* finer *comb spines;* apical tarsal joint without under side spines. Calcaria of middle and hind tibiae dark, the longer one of the latter at least two-thirds as long as the metatarsus, *the calcar of the middle tibiae is almost as long as the metatarsus.* Claws dentate. Pulvillus very small, slender, comb bristles vestigial.

Habitat: Of this very characteristic species I know only one female, taken by Alfieri on 27.v.1934 on the Gebel Mansuria.

Species of EVAGETES (s. lat.) of uncertain position

Evagetes fertoni Vachal

1899. *Evagetes fertoni* Vachal, *Ann. Soc. Ent. France,* LXVIII, p. 538 (female).
1930. *Tachyagetes fertoni* Haupt, *Mitt. zool. Mus. Berlin,* XVI, pp. 693 and 696 (female).
— *Tachyagetes fertoni* Haupt, Pompilidae Palästinas, MS., p. 77 (female).

According to Haupt this species (described from Algeria but also found in Palestine) is black, with clypeus and base of antennae dark red, the former covered with pubescence; abdominal tergites I-III and the legs inclusive of coxae are paler red. Pubescence, also on the hind margins of the abdominal tergites, very finely grey to silvery. Wings shaded with grey and having slightly darkened apical margin. Shape of cells similar to that of *T. excellens* Haupt, i.e. cell r2 nearly triangular, but somewhat broader above, one-third as broad as below. (pol) = (ool). Eyes as broad as half of frons. Inner orbits convergent to vertex. Antennal 3 distinctly longer than 1 and 2 combined, 4 as long as this combination. Clypeus straight in front. Legs scarcely spinose, fore tarsi *without comb*. Length 7-9 mm.

This species does not agree with any one of the new species described above.

Genus ANOPLIUS Dufour

(cf. Haupt, *Mitt. zool. Mus. Berlin*, XV, 1929, pp. 118, 136-144).

Like *Pompilus*, but claws of male bifid, and the 6th tergite of the female with semi-erect, stiff, brittle and stout bristles. Cell r3 usually much narrowed above. Tarsal comb moderately long. Pulvillar comb dense, comparatively stout. Abdomen of male slender.

Key to Egyptian species

Females

1 (6) Abdomen at least with anterior tergites red.

2 (3) Tergites I-III red, with black hind margins; on segments II and III the black margin somewhat angularly protruding in the middle, into the red anterior part. Wings strongly infumated. .... **fuscus (L.)**

3 (2) Abdominal segments I-III red, with more or less conspicuous posterior margins of greyish pubescence, apical segments black, with or without grey hind margins. Wings paler at base.

4 (5) Comb spines of anterior metatarsus longer than apical width of metatarsus. Clypeus straight in front, with brown pubescence. The apical abdominal segments without grey pubescence at hind margins. .... **infuscatus Lind.**

5 (4) Comb spines much shorter than apical width of metatarsus. Clypeus slightly emarginated in front, with whitish pubescence. The apical abdominal segments have grey apical bands of pubescence. Antennae finer and longer. .... **tenuicornis spec. nov.**

6 (1) Body black.

7 (10) At least segments I-III of abdomen with more or less ill-defined basal bands of grey pubescence.

8 (9) Wings slightly infumated with dark margin, or strongly infumated. Cell r3 below somewhat shorter than r2. .... cf. *pruinosus* Haupt, *murinus* Haupt

9 (8) Wings nearly hyaline at base, dark in apical half and with dark apical margin. Cell r3 below somewhat longer than r2. .... **sinaiticus spec. nov.**

10 (7) The whole body with black pruinescence. Upper side of femora somewhat pilose. .... cf. *hierosolymae* Haupt

Anoplius fuscus (L.)

1812. Unnamed. Savigny, Descr. d'Egypte, pl. 18, figs. 7, 8 (female and male).
1843. *Pompilus sugillatus* Klug, Symb. phys., pl. 39, fig. 1 (male).
1871. *Pompilus fuscus* Walker, List Hym. Egypt, p. 15.
1927. *Pompilus* (*Anoplius*) *fuscus* Haupt, Monogr. Psamm. Europas, p. 232; fig. 109 (male). Many references.

Female: 7-15 mm. — Black, 1st to 3rd segment of the abdomen red, base of tergite I and hind margins of the remaining tergites black, apical tergite wholly black; the black margins somewhat produced anteriorly in the middle. Antennae and legs black. The f. *pagana* Dhlb., occurring in the warmer parts of Europe, and having red hind femora has not yet been observed in Egypt. Abdomen with fine grey pruinose pubescence, sides of thorax and coxae with black pubescence. Wings strongly infumated, with broadly darker apical margin.

Head not narrowed behind eyes, temples broadly rounded, i.e. head across temples about as broad as across eyes; in lateral aspect the temples are as thick as the eye. Orbits almost parallel below, convergent above. The eye somewhat narrower than half of frons. Apical margin of clypeus shallowly emarginated. Antennal joint 3 subequal to 1+2. Pronotum steeply declivous in front, with obtusely angled posterior margin. Postnotum short, scarcely visible in the middle, finely transversely striate. Propodeum strongly convex, with feeble longitudinal sulcus, the declivity somewhat depressed in the middle. Tergite I strongly convex, like the anterior body and the coxae set with raised black hairs. Tergite VI set with stiff, brittle, black bristles. Veins Rt1 and Rt3 curved, Rt2 straight but oblique; cells r2 and r3 below subequal in length, r3 strongly narrowed anteriorly, sometimes closed. Vein Cut1 interstitial or slightly postfurcal. Vein Cut of hind wing not quite vertical at apex, interstitial or slightly prefurcal. Metatarsus of fore legs with three short comb spines which are somewhat longer than the apical width of the metatarsus; the three inferior comb spines not longer than the lateral ones. Under side of apical tarsal joint with a double row of dark spines. The longer calcar of the hind tibiae two-thirds as long as the metatarsus. Claws dentate, pulvillus large, plate densely set with comb spines that distinctly surpass the pulvillus.

Male: 7-12 mm. — Body slender, particularly the abdomen. Interior orbits sometimes with yellow margins. Claws bifid. Genital plate flattened, broadly rounded at apex, carinated, the keel being high at base and continuing to the apex.

Habitat: Common in the Delta, the northern coast, in Giza province, in the oasis Siwa and in Sinai; in Upper Egypt we only know it as far south as Fayoum. All the year round.

Distribution: Europe, North Africa, North Asia.

Anoplius infuscatus (Lind.)

1926. *Psammochares (Anoplius) infuscatus* Haupt, Monogr. Psamm. Europas, p. 238, fig. 110. — Further references.

Female: 8-12 mm. — Body, legs and antennae black, abdominal segments I and II and base of III red. Pubescence pruinose, dark brown, on the under side and the coxae partly grey. Wings more or less slightly shaded, with dark apical margin.

Inner orbits parallel below, slightly concave above, the eye somewhat narrower than half of frons. Clypeus with anterior margin straight. Ocelli forming a right angle, distance between hind ocelli somewhat shorter than that between hind ocelli and eyes. Temples, in lateral aspect, about half as thick as the eye. Antennae rather stout, joint 3 as long as 1+2. Pronotum steeply declivous in front. Postnotum half as long as postscutellum, finely transversely striate, with median sulcus. Propodeum strongly convex, with long median sulcus, declivity triangularly depressed. Apical tergite densely set with stiff, black bristles. Cells r2 and r3 subequal in length below, r2 half as long above as below, r3 strongly narrowed anteriorly, or closed. Vein Cu1 interstitial or slightly postfurcal. Vein Cut of hind wing interstitial, not quite vertical apically. The *three* comb spines weak, short, as long as or slightly longer than the apical width of the metatarsus; the three short inferior comb spines subequal in length to the laterals. Claws dentate, comb bristles of the pulvillus as long as the latter. Longer calcar of hind tibiae three-fifths of the metatarsus. Apical tarsal joint with double row of bristles on the under side; these are vestigial or wanting in the male.

Male: 6-10 mm. — Coloration as in the female, tergite III, though, more extensively or wholly red, sometimes also base of IV red; the abdomen of small specimens is darker. All claws bifid, the interior claw of the fore legs, as in the former species, larger, slightly S-shaped. Longer calcar of hind tibiae two-thirds the length of the metatarsus. Genital plate narrowed towards apex, roof-like, keel slightly convex, the plate densely set with black hairs, rounded at apex; sternite V with deep, bell-shaped excavation, IV slightly and angularly excavated, the face somewhat deepened, densely pilose.

I know similar males that are smaller, have more strongly darkened abdomen, and a pedicellate cell r3. They may represent another species, though I prefer to consider them to be aberrant specimens of *infuscatus*, as long as females showing pedicellate cell r3 do not come forward.

Habitat: Common, on the northern coast, the canal zone, the Delta, Middle and Upper Egypt, up to Girga. All the year.

Distribution: Europe, North Africa, Asia minor.

Anoplius tenuicornis spec. nov.

Female: About 8 mm. — Body, legs and antennae black, abdominal segments I-III red. Body with fine pruinose pubescence which on the tergites IV and V becomes more conspicuous, grey and fascia-like, segment VI grey pubescent. Collar, frons and clypeus show a decumbent white pilosity; the pubescence of the legs is grey, the middle and hind tibiae are inferiorly brown pubescent. Wings almost hyaline at base, slightly shaded, gradually darkened towards apex, the apical margin darker, reaching the cells.

Eyes about as broad as half of frons, orbits interiorly evenly emarginated, frons above about as broad as below. Clypeus touching eyes, genae very short, the clypeus convex, with shallow emargination anteriorly.

Ocelli in rectangular position, (pol) = (ool). Temples (laterally) about half as thick as the eye or a little less. Joint 3 of the *slender* antennae scarcely longer than 1+2, but distinctly longer than 4, shorter than the interocular distance on the vertex. Pronotum short, parallel-sided, deeply and nearly angularly emarginated posteriorly. Scutellum little convex lengthwise, but transversely strongly so; sides of the dorsum only slightly rounded, nearly parallel, the scutellum is, therefore, little narrowed towards apex. Postnotum short, at most half as long as the postscutellum, transversely striate, with an indistinct clasp-like smooth place. Propodeum moderately and evenly convex, with deep median sulcus, finely sculptured, with normal declivity. Last tergite densely set with stiff, black bristles, base of the tergite (?always) with grey pubescence. Pterostigma narrow, about as broad as the space between Co and Sc; 1st and 3rd abscissa of R short, 3rd shortest; vein Rt1 and Rt3 curved; cell r3 above only about one-third as long as r2, below somewhat shorter than r2. Cu of fore wing ending far from apical wing margin; vein Cut1 interstitial. Vein Cut of hind wing strongly curved at apex, but still joining Cu in a pointed angle, interstitial. Metatarsal comb practically absent, the three small spines not quite as long as the apical width of the metatarsus. Longer calcar of hind tibiae about half (or somewhat more) as long as the metatarsus. Apical segment of the tarsi with a double row of small spines that are wanting in the male. Pulvillus broad, rounded apically, comb bristles numerous, somewhat surpassing it.

The female differs from the similar *A. infuscatus* by the somewhat longer and more slender antennae, the shorter comb spines of the metatarsus, being only half as long as in *infuscatus*, and the more slender fore tarsi. The clypeus is whitish pubescent, not brownish, as in *infuscatus*.

Male: 6-7 mm. — Black, tergites I-III red, III behind particularly at the sides somewhat darkened, the segments with *narrow* hind margins of grey pubescence, these fine fasciae being medianly slightly produced in front so that the apical margins appear slightly incised. Frons, clypeus, prothorax (with narrow median brown pubescent transverse band), and the rest of the thorax (except the brown pubescent scutum and dorsal portion of scutellum), with grey pubescence, as well as the coxae for the major part and the rest of the legs. Wings as in the female.

Eye somewhat narrower than half of frons, below about half as broad as frons. Temples (laterally) a little more than half as thick as the eye. Antennal joint 3 well twice as long as 2, as long as or little longer than 1, little shorter than 4, and twice as long as broad. Prothorax with sides scarcely convex, deeply emarginated behind, but only in the middle so. Sulcus of propodeum abbreviated behind. Genital plate broad, rounded at apex, with only fine and very short marginal setae; slightly raised roof-like beneath, without longer bristles. Venation as in the female, cell r3 nearly closed above. Vein Cut of hind wing little curved, meeting Cu in a pointed angle, scarcely prefurcal. Longer calcar of hind tibiae only a little longer than half of metatarsus. Pulvillus slender, with few comb bristles. Claws dentate, the tooth large, only slightly directed forward.

Habitat: Nahia, Cairo, Pyramids of Giza, Helouan (vii.-x.). Uncommon.

The male of this interesting and easily recognizeable species I had at first regarded as belonging to *Pompilus*. This species gives another proof for the weakness of the genera around *Pompilus*, since the male has not distinctly bifid claws, while the female is a true *Anoplius*.

Anoplius sinaiticus spec. nov.

Female: 10.5-11 mm. — Black; frons below and clypeus, hind margin of propodeum, the tibiae and the base of abdominal segments I-III (the following segments contracted) with *grey* pubescence, the remaining part of the body with dark brown pubescence. Wings hyaline at base, the fore wings infumated in apical half, both darker at apex.

Eyes somewhat broader than half of frons, slightly emarginated within, frons below only very little narrower than above; frontal sulcus visible only above antennal cavities. Ocelli forming an almost pointed angle, (pol) distinctly more than 1/2 as long as (ool). Head, from above, much broader across eyes than across temples; the latter, in lateral aspect, scarcely half as thick as the eye. Antennal joint 3 slightly curved, longer than 1+2, even joint 4 longer than 1. Head with a few raised hairs. Clypeus very broad, laterally touching the eyes, in front very slightly and broadly emarginated. Pronotum deeply emarginated posteriorly. Postnotum long but somewhat shorter than the postscutellum. Propodeum normal, laterally with sparingly set raised hairs, without median sulcus. Apical tergite with dense black stiff bristles. Veins Rt1 and Rt3, the latter much longer than the former, cell r3 above about half (less) as long as below, where it is somewhat longer than r2, not closed; vein Cut1 distinctly somewhat postfurcal; Cu of fore wing reaching lateral margin only as a trace, not as vein. Vein Cut of hind wing as in *concinnus* Dhlb. Anterior metatarsus with three rather short comb spines the last of which is only half as long as the 2nd tarsal joint; under each comb spines there is an equal inferior one present; metatarsus about as long as the three following joints combined. Longer calcar of hind tibiae distinctly longer than half of the metatarsus. The double rows of spines on the under side of the tarsi are conspicuous, though wanting in the male. Claws dentate, pulvillus truncate at apex, broad, comb bristles rather dense, distinctly surpassing the pulvillus.

Male: 7 mm. — Black, very finely grey pubescent, temples with silvery white pubescence. The eye scarcely as broad as half of frons. Antennal joint 1 about as long as 3 or scarcely longer, the latter about twice as long as 2, 4 somewhat longer than 3. 1st and 2nd abscissa of R of fore wing subequal in length, 3rd about twice as long; *cell r3 petiolate.* Wings slightly shaded, gradually darker towards apex. Vein Cut of hind wing interstitial. Longer calcar of hind tibiae two-thirds as long as the metatarsus. Claws bifid. Abdomen slender. This male, taken at the same locality as the female, is most likely conspecific.

Habitat: Sinai, Wadi Gederât (v.), leg. H. Priesner.

Haupt's key to *Anoplius* (cf. *Mitt. zool. Mus. Berlin,* 1929, p. 138) leads to *A. concinnus* Dahlb.; our species differs by its much more conspicuous grey pruinosity of the base of the tergites I-III of the abdomen, the distinctly postfurcal nervulus (Cut1), the basally hyaline wings, and the 4th tarsal joint of the hind legs which is distinctly longer than broad. From Haupt's Palestinian species *A. pruinosus* and *A. murinus* it is at once distinguished by the basally hyaline wings, the longer joint 3 of the antennae, the ratio between width of eye and frons and the absence of the propodeal sulcus.

Genus DICYRTOMELLUS Gussak.

1935. *Dicyrtomellus* Gussakowsky, *Konowia,* XIV, p. 135.
1929. *Dicyrtomus* Haupt, *Mitt. zool. Mus. Berlin,* p. 145.
1937. *Dicyrtomellus* Arnold, Psamm. Ethiop. Reg., pt. VII, p. 14.

Near *Pompilus.* Three radial cells. Clypeus wider than the frons at the bottom. Declivity of the propodeum slightly concave, with a rounded slight protuberance (callus) at the lateral margin posteriorly. Metatarsus of fore leg as long as the three following joints combined. Tarsal comb of female composed of very long spines. Pulvillar comb dense. Pterostigma *small.* Claws dentate or simple; claws of fore tarsus of male symmetrical.

The type of the genus (*luctuosus* Mocs. (=*cingulatus* Rossi)) shows affinities to the type of the genus *Pompilus* (*pulcher* F.), especially by the symmetrical fore claws of the male, the somewhat flattened comb spines of the anterior metatarsus, and the presence of under side spines of the latter.

Key to the Egyptian Species

1 (4) Body black, without grey transverse spots on the abdomen.
2 (3) Claws dentate (Fig. 25) .... **claviger (Taschbg.)**
3 (2) Claws unarmed (Fig. 26). .... **dentiprivus spec. nov.**
4 (1) Abdominal tergites I-III with a transverse spot of grey pubescence on either side, tibiae beyond base with a longitudinal spot of grey pubescence .... cf. *luctuosus* (Mocs.)

Dicyrtomellus claviger (Taschbg.)

(Fig. 21)

1812. Unnamed, Savigny, Descr. d'Egypte, pl. 18, fig. 4.
1869. *Pompilus claviger* Taschb., *Zeitschr. Naturw.,* XXXIV, p. 51 (female).
1886. *Pompilus platyacanthus* Kohl, *Verh. zool. bot. Ges. Wien,* XXXVI, pp. 315, 322, pl. X, fig. 2.
1929. *Dicyrtomus claviger* Haupt, *Mitt. zool. Mus. Berlin,* XV, p. 148, fig. 32. (further references).

Female: 9-22 mm. — Black, anterior body (head and thorax) dull blackish red. Wings strongly infumated with slight blue lustre. Without conspicuous raised pilosity except at the temples.

Eyes distinctly narrower than half of frons, not emarginated within. Frons with distinct fine sulcus. Ocelli forming an obtuse angle, (pol) : (ool) = 2:3. Genae well developed, about as long as antennal joint 2. Temples, in lateral aspect, widened towards mandibles, below as thick as the eye. Antennal joint 3 much longer than 1 and 2 united. Prothorax somewhat rounded and narrowed towards apex, broadly emarginated behind. Propodeum strongly convex, dull, without raised hairs, with deep median sulcus, at the declivity somewhat excavated. Abdomen, like the thorax, with dark brown pubescence. Apical tergite without raised hairs. Pterostigma small; vein Cut1 interstitial; vein Rt1 and Rt3 strongly curved, the former rather oblique, cell r3 much narrowed above, but the cells somewhat varying in size, r2 always somewhat longer than r3, to 1.5 times as long; Cu of fore wing ending far from margin. Vein Cut of hind wing prefurcal, much curved at apex, but not quite rectangular upon Cu. Metatarsus of fore leg with 6-8 flattened comb spines, and with 4-5 inferior fine comb spines; the ultimate of the lateral comb spines reaches at least the middle of the 3rd tarsal joint. Calcar of hind tibiae less than half as long as the metatarsus. Apical joint of tarsi without inferior spines. Pulvillus large, widened towards apex, nearly bilobed, with 15-16 stout curved comb bristles that surpass it. Claws distinctly dentate.

Male: 8-15 mm. — Claws dentate. Genital plate large, smooth, narrowed towards apex, raised roof-like towards middle, high at base and declivous therefrom.

Habitat: The species is common in Egypt and was found all the year round. Localities: Mansuria, Khatatba, Kerdasa, Borgash, Abu Rowash, Kafr Hakeem, Giza, Beni Youssef, Dahshour, El-Wasta; Maassara, Helouan; Gebel Asfar, Wadi Umm-Assaad, Suez Road; Ismailia, Ghobbet El-Bous; Sinai (Romani, Akaba).

Dicyrtomellus dentiprivus spec. nov.

Female: 11-19 mm. — Black, head in front, or only both orbits, dark reddish, sometimes also the sides of the scutellum and postscutellum and the whole propodeum dull dark red, seldom segment 1 of abdomen slightly reddened. Wings strongly infumated, but without metallic lustre.

Frons below very slightly broader than above between the eyes, the latter only very slightly emarginated. Half of frons about 1.5 times as broad as the eye. Genae conspicuous, clypeus not quite reaching eyes, broad and truncate at fore margin. Distance of hind ocelli *mostly* shorter than (ool). Position of ocelli about rectangular. Temples, in lateral aspect, widened below, above scarcely more than half as wide as the eye, below about as wide. Antennal joint 3 longer than 1 and 2 combined. Head with short raised pilosity, propodeum at the sides with somewhat longer hairs. Prothorax short, slightly narrowed anteriorly, steeply declivous in front, hind margin either angular or arched. Scutellum convex, with a few raised hairs like the postscutellum. Postnotum scarcely half as long as the postscutellum, slightly constricted in the middle, finely transversely striate. Propodeum with median sulcus, somewhat excavated at the declivity, the reflexed hind margin angular at the sides. Abdomen with very fine pruinose dark probescence. Vein Rt1 and Rt3 strongly curved, Rt2 straight; cell r2 somewhat longish, above twice (in small specimens little) longer than r3, the latter strongly (in small specimens moderately) narrowed towards fore margin. Vein Mt3 ending in, or proximal to, middle of r3; vein Cut1 interstitial; Cu of fore wing not quite reaching margin. Vein Cut of hind wing interstitial or slightly prefurcal, not quite rectangular upon Cu, at apex. Apical tergite without raised bristles. Metatarsus of fore leg with 6-8 very long flattened comb spines, more so than in *claviger,* and with 6-10 fine inferior comb spines, whilst *claviger* has fewer inferior comb spines. Metatarsus as long as or longer than the three following joints united. Penultimate joint of hind tarsi with long spines, ultimate joint bare, without spines on the under side. *Claws without tooth in all specimens.* Pulvillus not reaching middle of claws, comb bristles numerous, surpassing pulvillus.

Male unknown.

Habitat: I saw specimens from Salloum, from Middle Egypt (Borgash, Sentris) and from the oases Kharga and Dakhla (ii.-v.).

This species is very similar to *D. claviger,* but differs by its always unarmed claws, the stouter, on an average more numerous, lateral and particularly the numerous inferior comb spines of the metatarsus, the shorter and more slender pulvillus and the longer cell r2 in comparison with r3.

In the Museum of Vienna there are among the specimens of *D. platyacanthus* Kohl, of which a specimen bears the type label Kohl's, two specimens of *D. dentiprivus* m., one of which also bearing a type label « *platyacanthus* ». Since the majority of the specimens of Kohl's belong to *claviger* I preferred to maintain Haupt's synonymy, and to create a new name for the species without tarsal tooth.

Other North African species: *Dicyrtomellus polyspathus* Morice (13) (*Novit. Zool.,* XX, 1913, p. 601, pl. XV, figs. 1-4, female) is a similar species, but not a synonym of *D. claviger* (Taschb.) sensu Haupt. Morice states in the description that the insect is like a colossal *D. platyacanthus* Kohl = *D. claviger* (Taschb.), Hpt., of 22 mm. length, and further differs in having 9 comb spines, the cell r2 longer than r3 (i.e. below more than 1.5 times as long), and in the peculiar microsculpture of the abdomen, the tergites having transverse rows of very minute punctures which are not confluent, whereas in *claviger* (and in *dentiprivus* n. sp., too) the surface is extremely finely transversely striate or chagreened. The face is more transverse than in *D. claviger* (Algeria).

Dicyrtomellus sexspinosus Saunders (*Trans. Ent. Soc. London,* 1901, p. 500), like the former unknown to me, differs from *D. claviger* chiefly in having the head entirely black, and the mandibles and eyes contiguous. Length 12 mm. Biskra.

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(13) Haupt (*Mitt. Zool. Mus. Berlin,* XV, 1929, p. 148) puts this species as a synonym to *D. claviger,* and mentions Kohl as author of the species. The same error I find in the *Zool. Record* of 1913.

Genus BATOZONELLUS Arnold

1937. *Batozonellus* Arnold, Psamm. Ethiop. Reg., pt. VII, p. 1.

Three radial cells. Squamiform hairs present only on the first tergite, sometimes scarcely visible. Joints 5-11 of the male antenna concave above, convex beneath. Anterior claws of female bifid, middle and hind claws dentate; claws of male bifid. Vein Cut of hind wing in both sexes *strongly* postfurcal, distance between it and Cu being greater than the length of Rt3. Sternite VI of male with a small compressed tooth on either side of the middle of the hind margin.

Batozonellus fuliginosus (Klug)

1834. *Pompilus fuliginosus* Klug, Symb. phys., pl. 38, fig. 6 (female).
1834. *Pompilus festivus* Klug, l.c., pl. 38, fig. 8 (male), doubtful (see below).
1937. *Batozonellus fuliginosus* Arnold, Psamm. Ethiop. Reg., pt. VII, p. 3 (both sexes), fig. 1 (male). Further references.

Female: 15-21 mm. — Body black, both orbits darker or paler red, or head and pronotum dark blackish red; dorsum with blackish brown pubescence, that shows on the abdomen a blue sheen in certain directions. Antennae black in the f. *vindicata* Smith, with brownish under side, or ferruginous to orange in the f. *bretoni* Guér. In the typical form (from Dongola, not recorded from Egypt) the wings are yellowish brown, infuscated, with darker apical margin. In ff. *vindicata* and *bretoni* the wings are blackish with strong blue lustre.

The raised pilosity of head, prothorax, postscutellum and propodeum short, only at the temples long. Frons below more than 1.5 times as broad as above; orbits below nearly parallel, strongly convergent above. Ocelli forming a blunt angle, (pol)=(ool). Eyes below much narrower than half of frons. Antennal joint 1 short, even joint 5 longer, joint 2 very short, joint 3 curved, more than 1.5 times but less than twice as long as joint 1. Prothorax slightly narrowed towards apex, in front, at the sides rounded and somewhat widened; hind margin not depressed and sulcus vestigial. Scutellum transversely and lengthwise convex, notauli of the scutum distinctly incised behind. Postnotum somewhat shorter than the postscutellum, with sulcus. Propodeum not much convex longitudinally, with rough sculpture, dull, a transverse striation seems to be indicated. Apical abdominal tergite only at the sides with some hairs, sternites with some black hairs. R of fore wing obtusely angled, cell r2 longer than high and indistinctly shorter than r3; Rt1 slightly curved, Rt2 distinctly S-shaped, cell sc lower than cells r. Vein Cut1 interstitial; Cu does not reach the apical margin. Vein Rt3 of hind wing oblique, somewhat curved, vein Cut hook-like at apex, *very strongly postfurcal*, about for the length of the 3rd joint of the hind tarsi. Metatarsus of fore legs with three moderately long comb spines of which the last is about as long as the 2nd tarsal joint (or less), in small specimens only half as long; inferior comb spines wanting. 5th tarsal joint with a double row of conspicuous spines on the under side. Claws of middle and hind tarsi distinctly dentate, of fore tarsi bifid. Pulvillus small, with few comb bristles.

Male: Arnold regards *Pompilus festivus* Klug as the male of *fuliginosus*, but Haupt (cf. Pomp. Palästinas, MS.) does not agree with this synonymy in stating that he possesses the female of *festivus* from South Africa. He puts *festivus* to the genus *Episyron*. A unique male of *festivus* is in Alfieri's collection (from Gabal Asfar near Cairo), and the description of it will be found under *Episyron*.

The female of this interesting species is at first sight somewhat similar to *Cyphononyx sabulosus*, owing to the blue sheen of wings and body and the yellow antennae of its f. *bretoni*, and was actually found mixed with the former species in the collection of the Ministry of Agriculture. It is easily distinguished by the tarsal comb, the larger head, the interstitial nervulus, and the much postfurcal vein Cut of the hind wing, and so on.

Habitat: f. *bretoni* Guér.: Alfiah, Alexandria, Cairo, Barrage, Pyramids of Giza; f. *vindicata* Sm.: Cairo. Both forms are uncommon.

Distribution: Egypt, Central to South Africa, Arabia (Yemen).

Genus EPISYRON Schiôdte

Three radial cells. Vein Cut of hind wing interstitial or slightly postfurcal (in *festivus* strongly postfurcal), vertical. Pterostigma cell-shaped. Claws bifid in both sexes. Fore tibiae on upper exterior margin with some decumbent spines. Prothorax anteriorly, postnotum, propodeum and abdominal tergite I, besides the ground pubescence, with easily rubbed off white or metallic squamiform hairs. Inner orbits parallel below, converging above. Postnotum long, dilated arc-like on both sides of the middle of hind margin. Declivity of propodeum convex.

Key to Egyptian species

Females

1 (6) The whole wing strongly infumated or blackened.

2 (3) Wholly black, exterior and interior orbits testaceous. Head, thorax, coxae and femora with rather dense black pilosity. Position of ocelli rectangular (Palestine) .... cf. *orbitalis* Haupt

3 (2) Head, prothorax scutum and scutellum ferruginous, propodeum and abdomen black. Ocelli forming an obtuse angle.

4 (5) Metatarsus of fore leg with *three* comb spines. A dark streak running from the vertex to the base of the antennae. (Palestine). .... cf. *anticus* Hpt. (nec Klug)

5 (4) Metatarsus with *four* comb spines. Head unicolorous. **anticus (Klug)**

6 (1) Wings not wholly infumated, much paler at base than at apical margin. Legs ferruginous. Abdomen marked with yellow or nearly wholly ferruginous.

7 (8) Prothorax clothed with raised black hairs. Antennae black. Anterior metatarsus with four comb spines. Thorax black, *strongly* convex. Length 13 mm. .... **ferrantei spec. nov.**

8 (7) Prothorax without erect black pilosity. Antennae at least beneath ferruginous. Anterior metatarsus with three comb spines.

9 (12) Head black or with pale orbits and (more or less) pale clypeus.

10 (11) Scutellum yellow posteriorly. Abdomen with conspicuous yellow basal fasciae on tergites II and III. .... **flavipes Haupt**

11 (10) Scutellum dark. Abdomen on tergites II and III with broad orange-yellow fasciae, segments IV and following segments ferruginous. Orbits narrowly, and clypeus for the major part, ferruginous. ... . **nubicus spec. nov.**

12 (9) Head red, with blackish longitudinal double line. Scutellum ferruginous, margined with black. Abdomen with yellow design, as a whole, ferruginous. Length 10.5-11 mm. ... **ferruginosus spec. nov.**

Males

1 (4) Wings almost uniformly and strongly infumated, without yellow spot at base.

2 (3) Hind margin of pronotum lined with yellow, this line sometimes interrupted. Orbits more or less marked with yellow. Cell r2 posteriorly as long as r3, not pointed proximally. 9 mm. (Palestine) .. .. cf. *orbitalis* Hpt.

3 (2) Head nearly black or very dusky ferruginous, without yellow markings. 11.5 mm. (Palestine). .... cf. *anticus* Haupt (nec Klug)

4 (1) Basal third of wing wholly hyaline or only slightly shaded, wing dark towards apex, with dark margin; or nearly hyaline with dark margin.

5 (6) Frons between antennae with yellow keel. Cut of hind wing very strongly postfurcal. Scutum with forked yellow spot. 11-17 mm. .. .. **festivus (Kl.)**

6 (5) Frons without longitudinal carina. Vein Cut of hind wing less strongly postfurcal.

7 (8) Body, legs and antennae black, only the inner and outer orbits lined with yellow. Wings without yellow spot at base.. **tristis spec. nov.**

8 (7) Head, prothorax and abdomen with yellow markings.

9 (10) Larger, 10-13 mm. Wings hyaline, with dark apical margin. Antennae long, ferruginous, joint 3 more than three times as long as thick. Sides of frons, clypeus, labrum, mandibles and nearly the whole prothorax yellow; scutum without yellow sopt, scutellum at least in the middle ferruginous. Base of wing, legs and coxae ferruginous.. **ornatus (Kl.)**
(?=*anticus* Kl.)

10 (9) Smaller, 5.5-7.5 mm. Antennae shorter.

11 (14) The whole femora ferruginous. Antennae below or wholly ferruginous. Squamiform hairs whitish.

12 (13) Wings slightly shaded, with dark apical margin; cell r3 below as long as or longer than r2. Post-ocellar distance somewhat shorter than ocello-ocular distance. Genital plate narrow, truncate at apex. (Palestine). .... cf. *minutus* Haupt

13 (12) Wings hyaline, with dark margin. Cell r3 behind much shorter than r2. Post-ocellar distancesubequal to ocello-ocular distance. Genital plate slightly rounded at apex. .... **nubicus spec. nov.**

14 (11) Base of femora black up to the middle. Antennae ferruginous. Scale hairs silvery to metallic. .... **flavipes Haupt**

Episyron anticus (Klug)

1834. *Pompilus anticus* Klug, Symb, phys., pl. 38, fig. 10 (female).
1901. *Pompilus fertoni* Saunders, *Trans. Ent. Soc. London,* p. 552,
— nec. *Episyron anticus* Haupt, Pompil. Palästinas, MS.

Female: 12-15.5 mm. — Head, prothorax, scutum and scutellum orange or dusky ferruginous; antennae, fore legs (inclusive of coxae), mid legs (exclusive of coxae) ferruginous, middle femora sometimes darkened at base; hind femora dark, tibiae dark or reddish, middle and hind tarsi more or less darkened. Scutum mostly blackened along the notauli or darker, in this case also the scutum with dark longitudinal streaks. Propodeum and abdomen black, with brown pubescence; in perfect specimens the tergites III-V are covered with grey, and only the posterior margins of the tergites III and IV with dark, pubescence. Wings stronlgy and evenly infumated, in some cases the apical margin again a little darker; wings with distinct violet lustre.

Eyes strongly emarginated within so that the *frons is above hardly more than half as broad as below.* Ocelli forming an obtuse angle, (pol): (ool) = 2:1. Genae short, clypeus practically touching the eyes, the brown fore margin truncate. Temples, in lateral aspect, about half as broad as the eyes. Pronotum emarginated posteriorly, forming an obtuse angle, Scutellum slightly compressed laterally. Venation normal, Cu not reaching margin.

Anterior metatarsus in all specimens with *four* long comb spines that are somewhat dilated, and there is an additional very small one present that is scarcely half as long as the 2nd; the ultimate comb spine of the metatarsus surpasses the middle of the 3rd tarsal joint; the under side bears three conspicuous comb spines, one of them at the extreme apex of the metatarsus. Antennal joint 3 much longer than 1+2, joint 4 subequal to 1+2.

Habitat: Cairo, Marg, Gebel Asfar, Meadi; Gebel Elba (coll. Min. Agric. and Alfieri); Fayed (coll. Priesner). Collected from vi to vii.

Haupt mentions this species from Palestine. From the description given by him it appears that it is a different species. It has 3 comb spines on the anterior metatarsus and the head shows a broad black streak from the vertex to the clypeus; cell r3 is somewhat longer below than r2; anterior half of pronotum black. Haupt also describes the male of this species which is subequal in colour to the female, whereas it is possible that the male of *anticus* is the one described below under Klug's name *ornatus*.

Episyron ornatus (Klug)

1834. *Pompilus ornatus* Klug, Symb. phys., pl. 38, fig. 7 (male).

Male: 10-12 mm. — Yellow, with black and red markings. Middle of vertex, frons to the antennal base, occiput (posteriorly), sides of prothorax anteriorly, scutum, sides of scutellum, postscutellum and propodeum, posterior margins of tergites I-V (I at posterior half, others more narrowly), sterna and coxae and the four last tarsal joints, *black;* antennae and legs, tips of coxae, middle of scutellum (sometimes more yellowish), *ferruginous.* Head in front, all orbits, prothorax, bases of abdominal segments and the whole tergites VI and VII and the exterior edge of the tibiae, *yellow.* Wings hyaline with dark veins and sharply defined dark apical margin. Head, prothorax, propodeum and sides of segment I with pale raised hairs. Tergite I in basal half clothed with pale, almost golden decumbent scales.

Eyes scarcely narrowed towards vertex, only slightly emarginated. Ocelli forming an obtuse angle, (pol) = (ool). Antennae long, joint 3 more than twice as long as 1. Cu of fore wing not fully reaching margin. Ultimate tarsal joint without row of inferior spines. Genital plate narrowed towards apex, where it is rounded, ventral face distinctly but bluntly carinated.

Habitat: This male was collected by Alfieri and Mochi on the same locality and the same date as the above described *E. anticus,* i.e. at Gebel Asfar (v.-vii). Klug's type specimen was taken at Fayoum.

Episyron ferrantei spec. nov.

Female: 15 mm. (in the unique specimen the segments of the abdomen are unnaturally distended, the normal length with segments contracted is about 13 mm.). — Black, the inner and outer orbits, a medianly interrupted narrow transverse line right in front of hind margin of pronotum, 2 very broadly separated transverse spots at the base of tergite II, 2 larger medianly not quite fused spots at the base of tergite III, and a small basal central spot on tergite VI, yellow. Legs ferruginous, coxae black, basal half (or more) of fore femora, extreme bases of middle and hind femora, and tips of tarsi blackish; fore tarsi almost wholly red; calcaria ferruginous. Wings almost hyaline in the basal cells, distinctly shaded with brown from basal vein onwards, and with still darker apical margin. Hind wings similar, but less strongly shaded. The whole body, especially the head, prothorax, the propodeum and the abdominal tergite I with moderately long, dense, raised pilosity. Tergite and sternite VI also with raised hairs.

Head not broader than the thorax. Eyes distinctly but slightly narrowed towards apex, only slightly emarginated within. Clypeus broad, well 2.5 times as broad as long, laterally touching the eyes, surface with longitudinal rugae, fore margin narrowly smoothened. Frons very finely rugosely punctured, with sulcus only above antennal cavities. The eye somewhat narrower than half of frons. Position of ocelli very slightly obtusely angled, (pol) scarcely longer than (ool). Temples, in lateral aspect, about half as thick as the eye or less; in dorsal aspect the temples are very flatly rounded. *Thorax strongly convex,* almost humpbacked. Prothorax short, steeply declivous in front, narrowed towards apex, sides scarcely convex, hind margin forming a shallow arc. Scutellum somewhat convex, like the postscutellum distinctly pilose. Postscutellum with median sulcus. Postnotum strongly emarginated in the middle, where it is very narrow, hind margin convex on either side. Propodeum very short, declivous from base, with short basal sulcus, not densely set with white squamae. Abdomen very finely sculptured. Fore wings with Rt1 strongly curved, Rt2 straight, Rt3 oblique, curved at base only; cell r3 above only half as long as r2, below somewhat shorter than r2; vein Cut1 scarcely prefurcal; Cu not reaching apical margin. Basal portion of R of hind wing three times as long as Rt3, the latter oblique; vein Cut semicircular at apex, slightly postfurcal. Comb spines of fore tarsi long, metatarsus with *four* lateral spines the last of which surpasses the 2nd tarsal joint and reaches about the middle of the 3rd; under side of metatarsus with *three* long comb spines of unequal length. Ultimate tarsal joint with an exterior row of spines on the under side. The long calcar of the hind tibiae about two-thirds as long as the metatarsus. Pulvillus slender, about half as long as the claws, comb bristles sparse.

Habitat: Egypt (no locality mentioned), leg. Ferrante (coll. Alfieri).

Episyron festivus (Klug)

1834. *Pompilus festivus* Klug, Symb. phys., pl. 38, fig. 8 (male).
1937. *Batozonellus fuliginosus* Arnold, Psamm. Ethiop. Reg., pt. VII, p. 3, fig. 1 (male).
— *Episyron festivus* Haupt, Pomp. Palästinas, MS.

This form is regarded as the male of *Batozonellus fuliginosus* (Kl.) by Arnold, obviously owing to the fact that the transverse anal vein of the hind wing is much more strongly postfurcal than in any other species of *Episyron*. Haupt states, however, in his paper on the Palestinian Pompilidae that he possesses a similarly coloured female from South Africa, and that the species *festivus* (Klug) is actually a true *Episyron*. Unable to give, owing to lack of material, a definite opinion on this matter, I am giving a description of the unique specimen from Egypt of Alfieri's collection.

Male: 12.5 mm. — Similar to *ornatus* (Klug), but much differing by the yellow carina between the antennal pits, the colour and the very strongly postfurcal vein Cut of the hind wing.

Head in front and at the sides to the upper margins of the eyes, and at the temples, pale yellow, with a black double longitudinal streak in the middle of the clypeus; prothorax pale yellow, only the declivity brown to black; scutum black, lateral margin yellowish, and with a yellow, anteriorly deeply incised spot in the middle posteriorly; scutellum yellow, medianly at base black, postscutellum and postnotum black; propodeum ferruginous, hind margin at the sides with two transverse yellow spots. Abdomen nearly wholly ferruginous and yellow, with very little black; segments II-IV with yellow fore margin, rest ferruginous (with narrow blackening at base), segments V and VI almost wholly yellow with very little red; sternites II-IV yellow at base. Legs ferruginous, fore coxae with large, middle coxae with small, yellow spot (at base), hind tibiae yellow above at least in basal half, tarsi yellow at base, blackened at apex, fore tarsi yellow above; calcaria yellow. Antennae pale ferruginous, joint 1 yellow beneath. Wings hyaline, fore wings with faint yellow shade, both with sharply defined dark apical margin.

Frons like in *E. ornatus*, but below in front of the antennae with a sharp yellow carina. Antennal joints more strongly curved than in *ornatus*, about as strongly as in *Paracyphononyx ruficrus;* joint 3 longer than 1+2, as long as 4. Temples, in lateral aspect, less than half as broad as the eye. Prothorax posteriorly broadly emarginated, with a small incision at the middle. Postnotum about as long as the postscutellum. Propodeum pilose, silvery scales scarce, also on tergite I not conspicuous. Radial cells larger, broad, also above. Cut of hind wing strongly postfurcal, for a greater distance than the length of Rt3. Pulvillus large, slender.

Habitat: 1 male, Gebel Asfar, 22.x.1933, leg. Alfieri.

The specimen differs somewhat, though most likely not specifically, from the illustration given by Klug (l.c., fig. 8) in having darker tibiae, ferruginous propodeum and by the lack of the yellow spots on tergite I of the abdomen.

Episyron flavipes Haupt

Episyron flavipes Haupt, Pompil. Palästinas, MS. (male).

Male: 5.5-6.5 mm. — Black, body without ferruginous, but only with yellow, markings. Inner orbits broadly, outer orbits narrowly, the lateral two-thirds of the clypeus (central third black), the broad posterior margin of the prothorax, a small spot on the scutum (posteriorly) and one on the scutellum, two transverse triangular spots on tergites II and III, *yellow*. Antennae ferruginous, brownish above towards apex, joint 1 dark, yellow beneath. Legs ferruginous, coxae and base of femora black, hind tibiae exteriorly beyond base with a yellow streak; tarsi yellow to ferruginous, tips of joints 1-3 of the middle and hind tarsi dark, joints 4 and 5 wholly dark. Wings slightly shaded, with blackish apical margin.

The eye about as broad as half of frons, orbits slightly emarginated above, frons below narrower than above. Clypeus scarcely emarginated in front. Temples, in lateral aspect, narrow, widened below, in the middle scarcely thicker than one-fourth of the eyes. Antennae comparatively *short* and stout, much thinner towards apex, joint 1 scarcely longer than broad, 2 very strongly transverse, 3 or 4 very slightly longer than 1. Prothorax shallowly emarginated posteriorly, densely clothed with pale yellow squamae in front, besides, with some raised hairs laterally. Propodeum rather flat, broader than long, with greenish squamiform hairs posteriorly, while those on tergite I are reddish-golden. Propodeum with some pale raised hairs at the hind angles. Abdomen *short*. Vein Cut1 prefurcal; Cu ending far from apical margin; pterostigma small but transparent, cell-like, little more than one-fourth as long as cell sc at the fore margin; veins Rt1 and Rt3 curved, Rt2 straight; 1st and 2nd abscissa of R subequal in length, 3rd shorter, 4th twice as long as 1st or 2nd; cell r3 below much shorter than r2, above one-third to one-half as broad as below. Mt2 of hind wing vertical upon Cu with very short base, Cut vertical, distinctly postfurcal. The long calcar of the hind tibiae for one-fifth to one-fourth shorter than the metatarsus.

Habitat: Helwan, x. (coll. Min. Agric.).

I identified this male with *flavipes* Haupt since it agrees well with the original description, apart from the metallic colour of the propodeal squamae, while those of the Palestinian specimens of Haupt are silvery. To the same species I am much inclined to refer a unique female specimen of Alfieri's collection, of which I am giving the following description.

Female (= *Episyron bifasciatus* Pries. in sched.), 9 mm. — Black, with ferruginous and yellow markings. Orbits broadly ferruginous, a large spot on the frons from the ocelli to the bases of the antennae, black; antennae ferruginous, above towards apex black; prothorax and scutum black, the former except the ferruginous hind margin, the latter except the ferruginous sides and a small such spot in front of hind margin; basal half and sides of scutellum, the postscutellum, propodeum and abdomen black, except a broad, medianly incised yellow basal band of the tergites II and III; coxae and trochanters (excepting the reddish tips of the former) black; legs and tegulae ferruginous; more yellowish is the posterior part of the scutellum. Fore wings scarcely shaded, with dark apical margin, hind wings hyaline with dark apical spot.

Frons below between eyes little broader than above on the vertex, eyes slightly emarginated above. Clypeus about three times as broad as long, slightly rounded in front. Ocelli forming an obtuse angle, (pol) hardly longer than (ool). Temples about half as thick as the eyes. Prothorax with hind margin forming a shallow arc. Scutellum flat dorsally, sides not sharp-edged. Postnotum shorter than the postscutellum. Propodeum narrowed posteriorly, with extremely fine ground-sculpture, slightly shining, with pale squamiform hairs laterally and posteriorly, and with raised white hairs at the posterior angles. The black abdominal tergite I with golden squamae; tergite VI with about four black bristles. Cell r3 strongly narrowed above, where it is more or less narrower than r2; vein Rt1 strongly oblique, curved only at extreme base (below). Vein Cut of hind wing semicircularly curved at apex, postfurcal. Basal part of R of hind wing three times as long as Rt3. Pulvillus large, with few but long comb bristles. Anterior metatarsus with *three* long comb spines the last of which surpasses somewhat the 2nd tarsal joint; only *two* inferior comb spines present, one of them at extreme apex.

Habitat: 1 female, Fayoum, 5. vi. 1935 (leg. Alfieri).

The above described female, though in some points agreeing with *ornatus* (male), cannot be referred to this species, but is most likely that of *flavipes* Haupt.

Episyron ferruginosus spec. nov.

Female: 10.5-11 mm. — Almost the whole body including the legs ferruginous, antennae scarcely darker at apex. Mesopleurae and propodeum black. Head from ocelli to base of antennae mostly with a black double line, or only with a black spot around the ocelli, and two dots above the antennal cavities. Clypeus and orbits sometimes flavo-ferruginous. Prothorax wholly ferruginous, or anteriorly at the declivity black, at hind margin mostly more yellowish. Scutellum ferruginous, margined with black. Abdomen at base of segments II-IV paler ferruginous to dark ochrous, but not yellow, perhaps as in *E. argillaceus* Arn., tergites V and VI somewhat paler, the anterior sternites more or less blackened at base. Legs wholly ferruginous, middle and hind coxae sometimes black, trochanters with black dot, fore coxae behind (above) black. Calcaria and spines of legs yellow. Wings pale or slightly shaded, with dark apical margin. Squamiform hairs on prothorax, propodeum and abdominal segment I dull yellow. Raised hairs whitish.

Inner orbits almost straight below, then emarginated and narrowed towards vertex, frons, therefore, broader below than above between the eyes. Temples in lateral aspect, more than half as wide as the eyes. Ocelli forming an obtuse angle, (pol) subequal to (ool). Sulcus of frons conspicuous. Clypeus nearly three times as broad as long, straight in front. Antennal joint 3 longer than 1 and 2 combined, 4 somewhat longer than 1. Distance of eyes on vertex as great as or somewhat greater than antennals 2 and 3 combined. Prothorax strongly narrowed towards apex, strongly declivous in front. Propodeum slighty and evenly convex. Apex of abdomen below with a few black hairs. In the fore wing the *first three abscissae of R are subequal in length*, or the 1st is scarcely shorter than the subequal 2nd and 3rd; Rt1 and Rt2 vertical and straight; cell r3 behind usually a little shorter than r2. Cut of hind wing distinctly postfurcal. The longer calcar of the hind tibiae two-thirds to three-fourths as long as the metatarsus. Anterior metatarsus with *three* yellow comb spines the last of which reaches the apex of the 3rd tarsal joint almost or wholly; *two inferior comb spines present*. Interior branch of the bifid claws truncate, half as long as the exterior one. Apical joint of hind tarsi with double row of small spines.

Habitat: 3 females, Gebel Elba, Wadi Aideb and Wadi Kansisrob, ii.-iii., leg. H. Priesner.

I should have referred this species to *E. histrio* Lep., unknown to me, but it agrees as to its coloration much more with *argillaceus* Arn. from which it differs structurally; the female of *histrio* has the femora striped with black, the propodeum partly *ferruginous* posteriorly, the 1st abdominal segment partly black, the tergites II and III have yellow transverse bands or spots.

Episyron nubicus spec. nov.

Female: 8 mm. — Black, inner and outer orbits narrowly ferruginous, hind margin and hind angles of prothorax indistinctly reddened. Antennae dark dorsally, ferruginous beneath. Legs ferruginous, coxae and trochanters dorsally black, spines of legs pale. Abdomen with segment I dark, with reddish sides, segments II and III at base broadly pale ferruginous, this coloration indistinctly narrower in the middle (perhaps even interrupted in other specimens), segment IV and following segments pale ferruginous. Wings nearly hyaline, with blackened apical margin. Head with short, raised, pale pilosity. Squamiform hairs on prothorax and propodeum grey, on segment I of abdomen greyish yellow.

Orbits parallel below, strongly converging in upper half, frons, therefore, much broader below than on the vertex. The eye scarcely narrower than half of frons. Frontal sulcus conspicuous. Temples, in lateral aspect, slightly widened towards the mandibles, well half as thick as one eye. Ocelli forming nearly a right angle, (pol) somewhat longer than (ool). Temples densely white pilose. Prothorax steeply declivous anteriorly, little emarginated posteriorly. Postnotum narrow in the middle, one-third as long as the post scutellum, slightly widened at the sides of the hind margin. Propodeum without noticeable median sulcus. Segment I of abdomen strongly convex, apex of abdomen with a few long bristles beneath. Vein Cut1 of fore wing strongly oblique; only Rt3 somewhat curved, the three abscisse of R subequal in length; cell r2 below somewhat longer than r3; 2nd recurrent vein (Mt3) ending at the middle of cell r3. Vein Cut of hind wing strongly curved at apex, somewhat postfurcal. Anterior metatarsus with *three* comb spines of unequal length, the ultimate of them far surpassing tarsal joint 2, and reaching almost the middle of joint 3; comb spines not lanceolate; those of the under side of the metatarsus (1 in the middle, 1 at the apex) *very* short. Last tarsal joint with double row of fine spines beneath.

Male: 6.5-7.5 mm. — Black, mandibles, labrum (except the base), sides of clypeus, orbits (interiorly about up to the emargination of the eye), prothorax (except dark apex and lateral spots), tegulae, a medianly narrowed basal band on the tergites II and III, the hind margin of tergite IV, and the whole tergite VII, pale *yellow*. Antennal 1 black with yellow spot at apex below, flagellum red, samewhat blackened dorsally. Coxae and trochanters dark, apices red, femora and tibiae ferruginous, fore and hind tibiae lined with yellow exteriorly, the latter only for two-thirds of their length, all tarsi yellow, middle and hind tarsi with blackened tips of joints 1-2 (-3), and dark joints (3-) 4-5. Body with adpressed and somewhat raised silvery white pilosity, squamiform hairs whitish to yellowish. Cells r far from apical margin. Frons between eyes narrower below than above.

Habitat: 1 female, 2 males, Gebel Elba, Wadi Aideb (i), leg. Priesner.

Episyron tristis spec. nov.

Male: 8-8.5 mm. — Black, inclusive of legs and antennae, tips of femora and tibiae within scarcely reddened. Inner and outer orbits very narrowly yellow. Wings hyaline in basal third, otherwise distinctly shaded and, besides, with dark apical margin.

Eyes large, emarginated within, broader than half of frons; the latter below scarcely narrower than above. Sulcus of frons visible only right above antennal cavities. Head with short raised pilosity. Clypeus truncate in front, genae shorter than the short antennal 2. Ocelli forming an obtuse angle, (pol) subequal (ool). Temples, in lateral aspect, narrow, less than half to one-third as broad as the eye. Antennal 3 almost shorter than 1, about 2.5 times as long as the *transverse* joint 2. Pronotum strongly narrowed towards apex, anterior declivity vertical; hind margin forming a shallow arc; dorsum with raised black pilosity, besides, with very few whitish squamiform hairs. Postnotum somewhat but little shorter than the postscutellum, narrower in the middle, impressed. Postscutellum sparingly set with fine raised black hairs. Propodeum slightly convex, declivity with a triangular impression, and otherwise with single whitish squamiform hairs. Tergite I at base with raised dark pilosity and in between with whitish scales. Genital plate flat in the middle, rounded apically, without conspicuous bristles. Vein Cut1 (nervulus) of fore wing interstitial, oblique; pterostigma short, its length scarcely one-third of fore margin of cell sc; Rt1 and Rt3 slightly curved, Rt2 vertical; 1st and 3rd abscissa of R subequal, 2nd abscissa longer than these, but shorter than 4th. Cu of fore wing not reaching margin. Vein Cut of hind wing strongly curved at apex, vertical upon Cu, postfurcal. Fore tibiae with 4 small spines on the upper exterior margin. Anterior metatarsus about as long as the three following joints combined. Apical joint of hind tarsi without spines on the under side. Large calcar of hind tibiae two-thirds as long as the metatarsus. Pulvillus large, with numerous fine comb bristles which do not surpass it.

Habitat: 1 male, Esbeth El-Nakhl, ix. 1933, leg. Priesner.

Genus SCHISTONYX Saussure

1929. *Schistonyx* Haupt, *Mitt. zool. Mus. Berlin,* XV, p. 179.
1937. *Schistonyx* Arnold, Psamm. Ethiop. Reg., pt. VII, p. 10.

Three radial cells (in abnormal cases only two cells in the male). Clypeus not wider than the bottom of the face. Cheeks very short. Declivity of propodeum steep, flat. Pterostigma rather small. Cell r3 often much narrowed above or petiolate. Vein Cut1 of fore wing (more or less) interstitial. Vein Cut of hind wing interstitial or prefurcal. Anterior tarsi comparatively *short,* metatarsus only as long as the joints 2 and 3 united, comb spines long, stout. Under side of tarsi with double row of fine short spines. Claws bifid in both sexes. Otherwise like *Pompilus.*

Key to Egyptian species

1 (4) Cell r3 above nearly or wholly closed or petiolate. Comb spines of 1st metatarsus somewhat dilated; apical inferior comb spine long, fine.

2 (3) Smaller species, 9-10 mm. Antennal joint 3 shorter than 1. Antennae red. The median inferior comb spine of the anterior metatarsus is wanting. .... **brevicornis spec. nov.**

3 (2) Larger, 10-16 mm. Antennal joint 3 at least as long as 1 and 2 combined. The median inferior comb spine present, as long as the apical one. .... **umbrosus (Klug)**

4 (1) Cell r3 above comparatively large, half as long as below. Metatarsus with finer comb spines, the apical of which little surpassing joint 2; besides, with a moderately long median and a very short apical *inferior* comb spine. Small species : 8 mm........ **minor spec. nov.**

Schistonyx umbrosus (Klug)

1834. *Pompilus umbrosus* Klug, Symb. phys., pl. 39, fig. 4 (female).
1929. *Schistonyx umbrosus* Haupt, *Mitt. zool. Mus. Berlin*, XV, p. 181 (further references).
1937. *Schistonyx umbrosus* Arnold, Psamm. Ethiop. Reg., pt. VII, p. 10, fig. 5 (further references).

Female: 10-16.5 mm. — Propodeum, abdomen, antennae and legs black, anterior body dull dark red, with brown pubescence; rubbed specimens collected in the autumn paler red, shining. Wings strongly infumated, without metallic lustre.

Orbits from the bottom towards vertex somewhat convergent, straight, slightly emarginated above middle and then narrowed. The eye somewhat narrower than half of frons. Temples, seen from above, narrow, strongly widened downwards, in lateral aspect. Genae developed. Antennal joint 3 longer than joints 1 and 2 united, in small specimens as long as 1+2. Ocelli forming an obtuse angle, pol=ool. Prothorax nearly parallel-sided, strongly narrowed only at apex, gradually declivous in front, slightly convex lengthwise ; in small specimens the profile forming a rounded obtuse angle ; hind margin deeply and evenly arched. Postnotum scarcely half as long as the postscutellum. Propodeum strongly convex, without median sulcus. Tergite 1 of abdomen vertical in front. Veins Rt1 and Rt3 strongly, Rt2 slightly curved; cell r3 below about as long as r2, above very strongly narrowed, nearly or wholly closed; vein Cut1 interstitial, strongly oblique; Cu of fore wing ending far from apical margin. Vein Cut of hind wing not quite vertical at apex, joining Cu in a slightly pointed angle, interstitial or a little prefurcal. Fore tarsi short, with stout, somewhat dilated comb spines, metatarsus with 3 lateral spines, one median inferior and one apical much smaller inferior spine ; preening organ at base occupying about one-third of the metatarsus. Pulvillus moderately large, comb bristle somewhat surpassing it. Longer calcar of hind tibiae well two-thirds as long as the metatarsus. Claws bifid.

Male: 5-11 mm. — Prothorax or only hind margin brown-red, or wholly black. Orbits ferruginous or yellow. Head in front with grey, the remaining body with brown, pubescence; propodeum posteriorly somewhat more strongly and unevenly raised pilose, sometimes (not always) with whitish squamae at the declivity, which are directed outwards. Antennal joints very slightly bent; antennal 3 a little shorter than 1, twice or 2.5 times as long as 2. Genital plate broadly rounded at apex, slightly convex, without long pilosity.

Habitat: A very common species, all over the country, the whole year round. I saw specimens from the oases Kharga and Dakhla and from the Sinai.

Schistonyx brevicornis spec. nov.

Female: 8-10 mm. — Anterior body rather pale ferruginous, especially in rubbed specimens, the whole antenna brown-red. From *Sch. umbrosus*, besides, differing in that the fore tarsi are shorter, the metatarsus being at most three times as long as broad, the median comb spine of the *under side* wanting, and only the *long* apical one present, and that the organ for preening at the base of the metatarsus occupies half of its length. Antennal joint 3 distinctly shorter than 1. Cell r3 of the fore wing is closed or mostly pedicellate. Prothorax in front more strongly declivous, about as in small specimens of *umbrosus*, and horizontal in its basal portion, in the profile.

Male: 5.5-7 mm. — The male most likely belonging to this species is rather similar to that of *umbrosus*, and is characterized by the pedicellate cell r3 whereby the vein Rt2 usually remains colourless or is not visible at all so that only two cells r remain. Head and prothorax may be wholly black, or the orbits are yellow, and the prothorax partly brown. The fore tarsi are only little shorter than in *umbrosus*.

Habitat: Sakkara (v., vi.), leg. Honoré; Maassara (x.), leg. Alfieri; Mansuriah, Kerdasa (v., vii.), leg. Priesner; Manshiet Radwân (vi.), coll. Min. Agric.

Schistonyx minor spec. nov.

(Fig. 27)

Female: 8.5-9 mm. — Head and prothorax more or less dull red to ferruginous, in rubbed specimens paler so; with black spot around ocelli; the remaining body, inclusive of antennae and legs, black. Hind wings less strongly infumated than in *Sch. umbrosus*, with dark apical margin.

Eyes slightly emarginated within, one eye somewhat narrower than half of frons. Temples, in dorsal aspect, narrow, in side view about half as thick as the eye. Ocelli forming an obtuse angle, distance of hind ocelli subequal to that between ocelli and eyes or little shorter. Genae shorter than in *umbrosus*. Antennal joint 3 as long as 1 and 2 combined. Prothorax at fore margin a little more than twice as broad as long in the middle, sides slightly rounded, hind margin slightly emarginated, a very fine median line may be indicated posteriorly ; pronotum convex lengthwise. Postnotum very short, postscutellum somewhat protruding in lateral aspect, more strongly convex than in *umbrosus*. Propodeum with declivous portion almost a little longer than the basal part, the former flat, the latter with median sulcus. Tergite I of abdomen vertical in front. Veins Rt1 and Rt3 curved, Rt2 very little so ; cell r3 in front shorter than r2, but much less strongly narrowed than in *umbrosus* ; Cut1 interstitial, slightly curved, *almost vertical;* longitudinal veins of fore wing ending far from margin. Vein Cut of hind wing interstitial at apex, steeper than in *umbrosus*. Fore tarsi short, anterior metatarsus with three lateral comb spines, the apical of which reaches or surpasses the apex of the 2nd tarsal joint ; on the under side there is a median comb spine present and a very small apical one ; organ for preening very short. Pulvillus about as in *umbrosus*. Claws bifid. The longer calcar of the hind tibiae shorter than in *umbrosus*, somewhat surpassing middle of metatarsus.

Male unknown.

Habitat: 2 females from Wadi Digla (v.), leg. Priesner, and 1 female from Abu Rowash (xi.), leg. Alfieri.

NOTE : Haupt described a similar species from Palestine, *Sch. nubilipennis*, which is entirely black, and has the infumation of the wing more confined to the interior of the cells. The ocelli are rectangularly posited. Like in *Sch. minor* the spines of the tarsal comb are not distinctly widened, and the minute spines between them (cf. *umbrosus*) are wanting, too.

Genus POMPILOIDES Radoszkowsky

1929. *Pompiloides* Haupt, *Mitt. zool. Mus. Berlin*, XV, pp. 149-155.
1936. *Pompiloides* Arnold, Psamm. Ethiop. Reg., pt. VI, p. 415.

Pterostigma very small. Three radial cells present, cell r3 much narrowed above or pedicellate. Veins Cut1 of fore wing, and Cut of hind wing interstitial. Anterior tarsi of female with well developed comb. Claws dentate or bifid. Pulvillar comb stout. Propodeum only slightly convex, without distinct declivity, produced at apex on either side into a blunt or pointed cone. Supra-antennal tubercle as well as postnotum obsolete.

Key to Egyptian species

1 (6) Legs black.

2 (5) Claws dentate.

3 (4) Under side of tarsi with double row of fine spines (3 pairs). Tergites I-III with spots of grey tomentum at the sides of the hind margin. .... **simulans spec. nov.**

4 (3) Under side of tarsi, besides the apical spine, bare. Tergites I-III of the abdomen with grey fasciae of the hind margin that are not or only narrowly interrupted in the middle. Smaller species. .... **deceptor spec. nov.**

5 (2) Claws bifid in both sexes. (Syria). .... **cf. moestus (Klug)**

6 (1) Hind tibiae red. Claws without distinct tooth. Cell r3 closed above or pedicellate. (Europe to Asia Minor). ... **cf. sexmaculatus (Spin.)**

Pompiloides simulans spec. nov.

1812. Unnamed, Savigny, Descr. d'Egypte, pl. 18, fig. 6, female.

Female: 8.5-11.5 mm. — Similar to *sexmaculatus* Spin., but differing not only in the arrangement of the grey spots of the abdomen, but also by the shape of cell r3, and the normally dentate claws and black legs ; in *sexmaculatus* the claws have a round excision near apex, and are thus neither dentate nor bifid. — Black. Indistinct grey spots on the head at the sides of the antennal cavities, at the fore angles of the prothorax, sides of the scutellum, middle of postscutellum, *in front of the hind angles of the propodeum ;* a spot of grey tomentum at the sides of abdominal tergites I-III (narrower on III), on the coxae, and grey are also the exterior margins of the middle and hind tibiae. Clypeus slightly reddish at fore margin.

Distance of eyes below subequal to that on the vertex. Distance of hind ocelli to distance between hind ocelli and eyes = 4:3. Temples, in lateral aspect, not half as thick as the eyes. Antennal joint 3 little longer than 1 and 2 combined. Genae short, clypeus touching eyes laterally. The indistinct declivity of the propodeum slightly shining, with median carina. Postnotum short, only 1/3 as long as the strongly raised postscutellum, emarginated in the middle, posteriorly. Apical tergite without conspicuous raised hairs. Wings, particularly cell sc and around basal vein, slightly shaded, besides, with dark apical margin. Longitudinal veins of fore wing ending far distant from apical margin; vein Rt1 strongly curved in the lower third, Rt2 oblique, straight, Rt3 strongly curved, but not fully closed, above about one-fourth as long as below; the recurrent veins (Mt) end slightly behind middle of the corresponding cells r, or Mt3 in the middle of r3. In the hind wing the vein Rt3 is strongly oblique, only about one-third as long as the

1st abscissa of R; vein Cut interstitial. Anterior metatarsus with three long comb spines, of which the apical spine slightly surpasses the 2nd tarsal joint; there is 1 median inferior comb spine present, and one vestigial apical spine. Apical joint of tarsi with a double row of very fine spines on the underside. Claws with conspicuous vertical tooth about at middle. Pulvillus about half as long as the claws, roundish, with 10-12 comb bristles.

Male unknown.

Habitat: Uncommon, but widely distributed. Localities: Abukeer (leg. Chakour); Kerdassa, Borgash, Mansuriah. Nahia, Abu Rowash (coll. Min. Agric.); Fayoum (leg. Alfieri); Helouan (leg. Priesner); Oasis Baharia (leg. Efflatoun and Tewfik). (ii.-v., viii.-xii.).

Pompiloides deceptor spec. nov. (14)

Female: 6.5-8 mm. — Black; grey pubescent on face and clypeus, the lower orbits, the pronotum anteriorly and its very narrow hind margin, the sides of the scutellum and, evenly grey, the postscutellum, the fore and hind angles of the propodeum, the coxae, exterior margin of the tibiae and a postero-marginal fascia on each of the tergites I-III of the abdomen, which are somewhat incised in the middle or at most narrowly separated. Fore wings rather pale, like the hind wings with dark apical margin.

Frons between eyes on the vertex scarcely narrower than below, (pol) : (ool) = 3:2. Temples and genae about as in *simulans*. Joint 3 of antennae scarcely longer than joints 1 and 2 combined. Posterior angles of the propodeum pointed, space between them slightly shining, without median carina. Tergite I beyond base with a narrow transverse band of brown pubescence. Metatarsus of fore legs with three black comb spines the last of which distinctly surpasses the apex of the 2nd tarsal joint: there is a median inferior comb spine present that is somewhat shorter. Claws distinctly dentate. Pulvillus nearly half as long as the claws, with about 10-12 comb bristles distinctly surpassing the apex of the pulvillus. Apical tarsal joint bare, without bristles of the under side. Calcar of hind tibiae surpassing at least half of metatarsus. Vein Rt1 strongly curved in basal third, Rt2 almost straight, Rt3 strongly curved, closed above; Cu of fore wing ending far from apical margin. Rt3 of hind wing well twice as long as 1st abscissa of R, vein Cut flat, interstitial or slightly prefurcal.

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(14) Haupt records *Pompiloides cinereofasciatus* Radoszkowski (*Hor. Ent. Ross.*, XXI, p. 94, 1887) from Palestine. — The original description by Radoszkowski (l.c.) runs as follows:

« Atra, opaca; segmentis tribus primis albofasciatis, cellula cubitalis tertia petiolata. — Femelle. Noire. Tête finement chagrinée, au milieu de la face une ligne verticale enfoncée, chaperon droit garni d'une poussière blanchâtre, mandibules roux. Corselet mat, la forme est celle de Salius; metathorax garni d'une poussière blanchâtre. — Abdomen mat; les trois premiers segments sur leurs bords postérieurs portant une large bande formée de poils longs, minces, couchés blancs. — Les tarses antérieurs pectinés. — Ailes transparentes, au bout enfumées. — Long. 5-7 mm. — Askhabad; elle se trouve aussi en Caucase. »

Our new *P. deceptor* comes no doubt close to this species. However, the original description of the Asiatic *P. cinereofasciatus* is not detailed enough to convince me of the identity of the two species. I prefer, therefore, to treat the Egyptian specimens as a proper species until a comparison with material from Turcmenia will be possible.

Male: The male that most likely belongs to this species is 3.5-8 mm. long, has the pronotum more evenly pubescent, but the three abdominal fasciae as in the female, with the addition that the 1st tergite is more whitish grey pubescent. Claws with small tooth. Cell r3 of fore wing strongly narrowed but not entirely closed. Longer calcar of hind tibiae three-fourths as long as the metatarsus. Sternite VI deeply emarginated behind, apical sternite *very* slender, lanceolate in shape, sharply pointed.

Habitat: The species is, though uncommon, represented by a few specimens in nearly all accessible collections, and was found at the following localities: Abu Rowash, Magadla, Kerdasa, Giza, Beni Youssef, Sakkara, Cairo, Helouan, Wadi Rashrash (iii.-xii).

Genus PARACYPHONONYX Gribodo

1929. *Paracyphononyx* Haupt, *Mitt. Zool. Mus. Berlin*, XV, p. 163 (key).
1936. *Paracyphononyx* Arnold, Psamm. Ethiop. Reg., pt. VI, p. 428.

Three radial cells, cell r3 much narrowed above or petiolate. Postscutellum and propodeal declivity with raised pubescence, the latter flattened or feebly concave. Clypeus not quite touching eyes. Legs strongly spinose, fore tarsi of female without comb. Males with antennal joints from 4th or 5th onwards concave above, swollen below at base. Head pilose. Declivity of propodeum with pubescence more abundant than in the female.

Key to Egyptian species

1 (2) Body and legs black .... **ater spec. nov.**
2 (1) At least the hind tibiae partly red.
3 (4) Black, hind tibiae for the major part ferruginous .... **ruficrus (Klug)**
4 (3) Black, anterior part of body ferruginous. (Palestine) .... cf. *semiochraceus* Haupt

Paracyphononyx ruficrus (Klug)

1812. Unnamed. Savigny, Descr. d'Egypte, pl. 17, fig. 22.
1834. *Pompilus ruficrus* Klug, Symb. phys., pl. 39, fig. 5 (female).
1834. *Pompilus tibialis* Klug, l.c., pl. 39, fig. 6 (male).
1929. *Paracyphononyx ruficrus* Haupt, *Mitt. zool. Mus. Berlin*, XV, p. 172 (further references).

1936. ***Paracyphononyx ruficrus*** **Arnold, Psamm. Ethiop. Reg., pt. VI, p. 432, fig 18 (further references).**

Female: 9-15 mm. — Black, with fine pruinose brown pubescence, abdomen in certain directions with bluish sheen; hind tibiae red, somewhat blackened at extreme base and apex, and with black spines, calcaria black, the longer one on the hind tibiae brownish. Body without raised pubescence. Wings slightly shaded with darker apical margin.

Eyes rather strongly emarginated within, frons below about as broad as above, the eye at least as broad as half of frons. Clypeus rather strongly convex, very slightly emarginated in front. Temples narrow, but widened below and reaching one-third of the eye's width. Ocelli forming an acute angle, (pol) much longer than (ool). Vertex, in dorsal aspect, broadly and shallowly emarginated behind. Antennal joint 3 almost as long as 1+2, more than three times as long as broad. Prothorax narrowed towards apex, sides nearly straight or slightly concave, deeply and angularly excavated at posterior margin. Scutellum horizontal and flat above, postscutellum little deeper. Postnotum about half as long as the former. Propodeum rather flat above, declivity almost triangularly excavated, hind angles blunt; edges of the reflexed margin sharp. Median sulcus (or foveola) indicated only anteriorly. Apical abdominal sternite setose. Vein Cut1 of fore wing strongly oblique, scarcely postfurcal; cell sc short, vein Rt1 and Rt2 strongly oblique, the former and Rt3 curved, Rt2 to pedicel straight, cell r3 pedicellate. Vein Cut of hind wing interstitial, not quite vertical at apex, Mt2 vertical upon Cu. Fore tarsi without conspicuous comb, the lateral spines not longer than the apical width of the metatarsus, only the inferior apical spine is somewhat longer. Middle and hind tibiae strongly spinose, the longer calcar somewhat more than half as long as the metatarsus. Apical joint of tarsi with a double row of about three very fine inferior spines, wanting in the male. Pulvillus large, comb bristles stout, curved. Claws bifid.

Male: 8-12 mm. — Coloration similar but the wings less distinctly shaded, the tergites (I-) II-IV with fasciae of grey pubescence that are interrupted in the middle; tergite VII ivory white. Clypeus, frons below and coxae with white pubescence. Head and prothorax with brownish raised pilosity. Postscutellum and propodeum (posteriorly) with somewhat felt-like dark pilosity. Antennae with distal segments strongly convex at base, obliquely truncate and thus inserted; joint 1 yellow beneath, joints 2-4 (-5) ferruginous or brownish beneath. Genae long. Frons below somewhat narrower than above.

Habitat: A common species, occurring all over the northern coast and the Delta, in Upper Egypt, also in the oases Kharga and Dakhla. All the year round.

Distribution: Asia minor; Africa from Egypt to the Cape.

Paracyphononyx ater spec. nov.

Female: 11-15 mm. — Black, with fine pruinose brown pubescence; prothorax at anterior and posterior margin sometimes with grey pubescence. Legs black, or slightly dark reddish transparent. Antennae brownish beneath. Wings evenly and strongly infumated, quite indistinctly violet. Head and pronotum anteriorly with slight very short raised pilosity, propodeum bare.

Orbits scarcely converging towards clypeus, quite indistinctly emarginated within. Width of eyes a little less than half of frons. Genae rather long. Clypeus not reaching eyes, smooth, shining, with a few shallow punctures, very indistinctly emarginated in front. Ocelli forming a slightly obtuse angle, (pol) a little greater than (ool). Temples, in lateral aspect, short, even below where they are somewhat broader than above only about one-third as thick as the eye. Antennae fine, long, joint 3 slightly curved, like joint 4 longer than 1 and 2 combined; joint 2 short. Thorax strongly convex, pronotum vertical in front, sides strongly narrowed towards apex, nearly straight, hind margin obtusely angled. Sides of scutum somewhat raised posteriorly. Scutellum broad, flattened dorsally. Postscutellum densely clothed with short, raised stiff bristles, with longitudinal impression posteriorly. Postnotum less than half as long as the postscutellum, with deep median sulcus and only very fine sculpture. Propodeum with an oblique small carina in front of the stigma, and an oblique impression in front of hind margin; scarcely convex, and impressed at the declivity which is bluntly margined in front; hind angles broadly rounded, bluntly produced. Fore wings with small pterostigma and rather high and short cell sc. Vein Rt1 little curved, Rt2 straight, Rt3 strongly curved so that cell r3 is above only one-third to one-half as long as below, where it is as long or a little longer than r2; Cut1 interstitial; Cu almost reaching apical margin of wing. Vein Cut of hind wing strongly curved at apex, but not quite vertical upon Cu, interstitial or slightly postfurcal. Fore tarsi without comb, the vestigial spines not longer than the width of the metatarsus. Apical joint of middle and hind tarsi with double row (1-3 pairs) of very small, fine spines on the under side, in the female only. Claws large, bifid with blunt interior branch ; pulvillus large, densely set with stout comb bristles which are at least as long as the pulvillus.

Male: 6.5-11 mm. — Legs mostly black, antennae reddened below. Head triangular in outline, genae very long. Antennae as in *ruficrus,* joint 3 longer than 1 and 2 combined, longer than 4. Pilosity as in the female, but propodeum at the declivity with distinctly pronounced short, felt-like black pilosity, like on the postscutellum. Pterostigma a little larger than in the female. Cell r3 very narrow above. Vein Cut of hind wing nearly vertical at apex, very little postfurcal. Tibiae spinose. In small specimens the wings are less strongly darkened and the vein Cut of the hind wing ends in a pointed angle, and may even be slightly prefurcal. Comb bristles of pulvillus less dense. Genital plate nearly semicircularly rounded at apex, more or less sharply keeled beneath, with rather long stiff bristles at the margin. In old specimens the antennae may be yellowish.

Habitat.: The species is uncommon, though represented in all available collections. Localities: Hamman, Ikingi, Amriah; Kerdassa; Wadi Digla, Wadi Umm-Assaad, Wadi Hof, Wadi Hussein, Wadi Rasheed (v.-x.).

Genus MICROPOMPILUS nov.

Body small and delicate, about 3 mm. long. Frons broad, vertex sharply margined posteriorly. Ocelli large, forming an obtuse angle. Antennae (of male) long and fine, evenly wide, joint 1 short, 2 well developed, following joints much elongate. Thorax strongly convex, prothorax strongly declivous in front, hind margin little arched. Scutum semicircular posteriorly, notauli rather far remote from the sides. Postscutellum deeper than scutellum. Postnotum scarcely impressed at middle, shorter, striation not noticeable. Abdomen (of male) short, slender, lanceolate, shorter than the thorax. Body *shining,* very finely sculptured, with comparatively sparse pale pubescence. Wings longer than the abdomen, with three radial cells which are much lower than the large, pointed cell sc. *Pterostigma very large*, little shorter at fore margin than cell sc. Vein Cut1 somewhat postfurcal. Cell m3 scarcely pointed at the lower proximal angle. Vein Cut of hind wing prefurcal, forming an oblique transverse vein, beginning at the analis at a blunt angle and ending upon Cu in a pointed angle. Legs very slender, hind tibiae pompiloid, with a few pale long spines at exterior margin. Pulvillus well developed, slender, without conspicuous comb bristles. Claws simple.

This form comes in the subfamily *Pompilinae,* near *Pompilus,* but differs by the sharply margined occiput, the large pterostigma, reminding of that of *Ichneumonidae* or *Braconidae,* the large cell sc, the strongly curved basal vein and the filiform antennae.

Micropompilus braconoides spec. nov.

Male: 2.7 mm. — Dull orange to brown, head and prothorax paler, testaceous, propodeum darkest, dark brown. Antennae yellow, the segments at the articulations darker. Legs pale brown, coxae darker. Wings hyaline, with brown veins that become much paler towards apices, stigma dark brown.

Head transverse, clypeus on the specimen stuck on a card not visible, frons very broad, more than 3, less than 4 times as broad as the eye. Ocelli large, strongly obtusely posited, distance of hind ocelli as compared to that between ocelli and eyes = 4:3. The hind ocelli lie at the margin of the vertex *that is sharply edged.* Antennae long and fine, about as long as the wings, joint 1 short, only twice as long as the well developed joint 2, 3 not quite twice as long as 1, almost times as long as 2, joint 4 nearly four times as long as broad, 5 or 6 subequal to 3, the following joints slightly decreasing in length; antennae not noticeably more slender towards apex, the joints parallel-sided, only the apical joints slightly convex below. Temples short, in lateral aspect probably one-third of eye. Thorax strongly convex, with prothorax declivous towards apex, sides narrowed anteriorly, straight, hind margin forming a shallow arc, but hind angles strongly produced backward. Mesonotum convex, semicircularly limited posteriorly, notauli fine. Scutellum broad, convex. Postscutellum deeper, postnotum scarcely half as long as the former, transversely impressed in the middle, only indistinctly striate at the sides. *Body shining,* finely and little densely pubescent, propodeum more strongly shining, possessing like the abdomen and the anterior body a very fine transversely alutaceous surface structure. Propodeum parallel-sided at base, rounded and narrowed behind, slightly convex, at the sides and posteriorly with finely reflexed margin, without median sulcus. Abdomen shorter than the thorax, narrowly lanceolate in shape. Veins Rt1 and Rt3 strongly curved, Rt2 vertical and straight cell r3 above almost as long or a little shorter than r2; cell sc large, pointed, much higher than the cells r; basal vein strongly curved; vein Cut1 slightly postfurcal; *pterostigma very large,* its area at least as large as cell r2, a little shorter than cell sc at fore margin; the two recurrent veins (Mt) ending in front of middle of their corresponding cells. Vein Cut of hind wing is a true transverse vein, i.e. forming an obtuse angle with analis, and a pointed one with the Cu, interiorly, and is strongly prefurcal. Legs long and very slender, fore tarsi with inconspicuous spines, joints 1 and 2 of them combined about as long as the fore tibiae. Hind tarsi very long, much longer than the tibiae, the latter about as long (or scarcely so) as 1st and 2nd tarsal joint combined. The white spines at the end of the tibiae somewhat splayed out, at the lateral margin of the tibiae are a few white *long* spines. The longer calcar of the hind tibiae about half as long as the metatarsus. Pulvillus well developed, slender, comb bristles extremely fine. Claws unarmed.

Habitat: 1 male, Wadi Hof, 29.x.1934, leg. Rabinovitch (coll. Alfieri).

Genus CHIONOPOMPILUS nov.

Male. — Body slender. Surface clothed with a *dense* decumbent pubescence of comparatively long and conspicuous white-grey hairs. Genae about as long as half of antennal joint 2. Antennae thick, longer than half of the body, *very slightly thickened* towards apex. Antennae situated on a slight elevation. Frons below distinctly narrower than above. Prothorax comparatively long. Notauli almost parallel, evenly incised. Postnotum short, bare, black. Propodeum narrowed from base to apex. Abdomen slender. Stigma slender, cell sc large; three radial cells present; vein Cut1 interstitial; Cu of fore wing reaching margin. Vein Cut of hind wing flat, prefurcal. Fore tarsi with lanceolate pale comb spines that are black at extreme base. Claws small, pulvillus large with conspicuous comb bristles. Tibiae white pubescent with very few black adpressed spines.

Female unknown.

Typ. gen. *Ch. rabinovitchi* spec. nov.

The antennae of this exceptional form remind somewhat of those of *Ceropales,* but are longer and more distinctly club-shaped. The abdomen is slender and elongate, the body densely clothed with a silky pubescence that is distinctly composed of conspicuous decumbent hairs covering the ground wholly. The transverse anal vein is not angular to analis. The fore tarsi have — even in the male — a long comb. The propodeum is slender at apex. The spines on apex of tibiae are splayed out. The genus belongs to the *Pompilinae,* and the female is expected to have exceptionally long comb spines.

Chionopompilus rabinovitchi spec. nov.

(Fig. 28)

Male: 7.5 mm. — Ground of body black, but covered everywhere with a very dense pubescence of comparatively stout adpressed hairs so that it appears wholly whitish grey. Antennae black, 1st and 2nd joint with dense white-grey pubescence. Raised hairs only at the temples. Coxae and femora dark with yellow tips, all tibiae yellow at extreme base and apex, tarsi ferruginous at base, the fore and middle tarsi have only the apical joint blackened, on the hind tarsi there are 2-3 apical joints darkened. The small spines on the middle and hind tarsi black. *Comb of the fore tarsi whitish, comb spines black at base.* Calcaria of middle and hind tibiae white. *Wings milky white,* with yellowish veins which become partly brownish towards apex; with a dark apical spot that reaches tip of cell sc at fore margin of wing but does by far not reach the other cells. Tegulae yellow.

Head, in frontal aspect, broader than long, clypeus convex lengthwise, evenly rounded in front, at the sides not quite reaching the eyes. Genae developed, about as long as half of antennal joint 2. Labrum emarginated in the middle, white pubescent. Palpi very long, joint 3 longest, all brownish.

Antennae (13-segmented) thick, longer than half of body, straight, slightly and gradually thickened towards apex, the joints are covered (from joint 3) at the anterior side with numerous very minute black spines; joint 3 about as long as 1 or 4; the segments decreasing in length towards apex, ultimate joint somewhat longer than 12th, rounded at tip. Antennae situated on a slight elevation, their distance from the clypeus equalling the length of antennal joint 2. *Frons below distinctly narrower than between the eyes on the vertex.* Eyes distinctly emarginated within, their width subequal to that of frons or very slightly less. Space between ocelli on a somewhat higher level than that between eyes and ocelli; position of the latter slightly acutely angled, (pol) : (ool) = 3 :4. Temples laterally with raised white pilosity, width scarcely one-third of eye. Prothorax comparatively long, slightly narrowed and rounded towards apex, moderately convex in a longitudinal direction, hind margin deeply excavated. Notauli almost parallel, evenly incised, laterally the scutum is slightly raised. Scutellum convex, not keeled or folded at the sides, truncate behind. Postnotum bare, not pubescent, scarcely transversely striate, and hardly half as long as the postscutellum, evenly wide at middle, widened only at sides, hind margin nearly straight. Propodeum from base slightly rounded and narrowed, with fine median sulcus, slender posteriorly, margin scarcely reflexed. Stigmata semi-elliptical, oblique, for less than their length distant from fore margin of propodeum. Abdomen very slender, about as long as head and thorax, broadest at the apex of segment II. Genital plate rounded (details invisible). Pterostigma slender, about half as long as cell sc at fore margin; cell r2 above and below somewhat longer than r3; cell sc large, little higher than cells r; vein Rt1 scarcely, Rt3 distinctly curved; veins Mt ending about in the middle of cells r2 and r3, respectively; vein Cut1 interstitial; cell m3 distinctly pointed; Cu attaining apical margin of wing. 1st abscissa of R of hind wing about 2.5 times as long as Rt3; vein Cut of hind wing flat, distinctly prefurcal, apical part of Cu curved in terminal third. Fore tarsi short (as long as width of head), metatarsus with three nearly lanceolate comb spines of which the apical one reaches the middle of the 3rd tarsal joint; besides, there are two long fine yellow inferior comb spines present. Claws small, pulvillus large, roundish, with 6-8 comb bristles which surpass the pulvillus; claws thick at base, simple. Hind tibiae (like all legs with dense white pubescence) with only one black spine in apical fourth of exterior margin, middle tibiae with 3 adpressed black spines, fore tibiae apparently without exterior spines. Hind femora without preapical spines. End of hind tibiae with 4-5 somewhat splayed out black spines.

Habitat: 1 male, Gebel Asfar, 12. xi. 1933, leg. A. Rabinovitch (coll. Alfieri).

Genus PROTELOSTEGUS nov.

Like *Telostegus,* but with three radial cells instead of two. — Body slender, legs and antennae slender, the former spinose, with very long tibial calcaria. Claws bifid. Eyes distinctly emarginated within. Clypeus strongly convex, broad, almost touching eyes. Temples, in dorsal aspect, very short, flat. Thorax, as in most *Telostegus,* convex, prothorax in front evenly convex and declivous, in dorsal aspect strongly narrowed towards apex. Postnotum long, bare. Propodeum only slightly convex, surface very finely aciculated, with conspicuous erect pilosity. Abdomen with whitish grey apical fasciae of pubescence on the tergites, apical segment little pilose dorsally, convex, finely pubescent. Wings narrow, folding lengthwise, as in *Telostegus.* Basal vein straight, Cut1 oblique, prefurcal. Three trapezoidal radial cells present; the first three abscissae of R subequal in length; vein Rt2 vertical, straight; cells r about as far apart from wing margin as their combined lengths; Cu of fore wing reaching margin. Venation of hind wing as in *Telostegus,* Mt2 vertical at base. Fore tibiae exteriorly with only two small spines. Comb of fore tarsi long.

Typ. gen. *P. arnoldi* spec. nov.

This genus comes closer to *Telostegus* than to either *Episyron* or *Schistonyx.* It is in the same way related to *Telostegus* as *Evagetes* is to *Pompilus.*

Protelostegus arnoldi spec. nov.

Female: 9 mm. — Black, body clothed with fine grey pruinose pubescence that becomes more brownish on the abdomen; the hind margin of the tergites and sternites I-IV bears a narrow margin of silvery white pubescence which is quite sharply defined. Prothorax with conspicuous silvery pubescence, as well as the under side of the thorax and the coxae. Temples, head dorsally, sides and anterior margin of the prothorax, the whole propodeum (rather densely) clothed with more or less dense silvery white raised pilosity. Comb of tarsi, tibial calcaria and spines brownish yellow. Wings little shaded, with dark apical margin, a dark spot also on cell sc.

The eye is about two-thirds as wide as half of frons; sulcus on frons inconspicuous. Clypeus strongly convex, straight in front. Temples, in lateral aspect, about half as broad as the eyes, in dorsal aspect quite flat. Ocellar triangle obtuse, (pol) little longer than (ool). Antennal 3 longer than 1 and 2 combined. Prothorax narrowed towards apex in straight lines, or slightly concave, hind margin shallowly arched, slightly angular at middle. Scutellum and postscutellum gradually declivous. Postnotum conspicuous, but shorter than the postscutellum, slightly excavated medianly at hind margin.

Propodeum evenly and slightly convex, surface finely aciculated, without median sulcus. Tergite I of abdomen little convex, tergite VI convex, with fine greyish-brown pubescence, not granulated. Wings with basal vein straight, strongly oblique, nervulus oblique, somewhat prefurcal. Cell sc somewhat closer to margin of wing than cell r3 at base, the three first abscissae of R subequal in length, 3rd abscissa 1.5 times as long; veins Rt1 and Rt3 curved, Rt2 vertical, straight; Cell r2 below somewhat longer than r3; Cu of fore wing nearly fully reaching margin. Vein Cut of hind wing slightly prefurcal, almost vertical upon Cu at apex. Fore tarsi slender, metatarsus with three long lateral comb spines, the apical of which reaches apex of 2nd tarsal joint. Pulvillus slender, nearly half as long as the claws.

Male unknown.

Habitat: 1 female, Gebel Elba, Wadi Aideb, 2.ii.1938, leg. H. Priesner.

Genus TELOSTEGUS Costa

Two radial cells, r2 trapezoidal. Mt2 of hind wing vertical at base. Wings folding longitudinally. Postnotum well developed, smooth. Antennae slender. Tibiae of fore legs with a few small spines at the upper exterior margin besides the interior and apical spines. Pubescence never hairy, but pruinose, on the anterior body and the abdomen never dense. Fore tarsi of female with long comb and mostly slightly dilated lateral comb spines of it. Thorax convex. Propodeum not excavated at the declivity. Claws bifid.

This genus is very well represented in Egypt.

Key to Egyptian species

1 (2) Antennae of male serrate. (Wings with milky opacity) .... **Subgen. Telostegoides nov. lacteipennis spec. nov.**

2 (1) Antennae of male not serrate .... **Subgen. Telostegus s. str.**

3 (4) Thorax strongly convex, humpbacked, prothorax steeply declivous. Propodeum strongly convex, with median sulcus. Black, abdomen with fine brown pruinosity. Vein Rt1 curved in the middle. Clypeus slightly incised in the middle of the fore margin. Wings very strongly infumated. Three lateral and two (one shorter and one longer) inferior comb spines present. Surface of tergite VI of female flattened, granulated. .... **convexus spec. nov.**

4 (3) Thorax less convex, not humpbacked; prothorax, scutum and scutellum forming, in lateral aspect, at most one quarter of a circle.

5 (37) Females.

6 (24) Dorsum of tergite VI (anal area) more or less flattened, bare, chagreened-granulated, dull, roughened.

7 (12) Abdomen partly red.

8 (9) Antennal joint 3 little longer than 1 and 2 combined (15). Postnotum obtusely angled at the middle of the apical margin. Surface of apical abdominal tergite with cupreous sheen. Tarsal comb paler, not black. 8-9 mm. .... **adulator spec. nov.**

9 (8) Antennal joint 3 much longer than 1 and 2 combined. Apical tergite dull black. Anterior metatarsus only with lateral, but without inferior comb spines. (pol) longer than (ool).

10 (11) Comb spines of fore tarsi dark. Postnotum only slightly shorter than postscutellum. Tergites I-III red. Wings with slight milky opacity. .... **melanurus (Klug)**

11 (10) Comb spines of tarsi yellowish. Postnotum half as long as postscutellum. Abdomen black, or tergites I and II red only at hind margin or with reddish lateral spot. .... **sabulicola spec. nov.**

12 (7) Abdomen entirely black.

13 (16) Joint 3 of antennae decidedly longer than 1 and 2 united.

14 (15) Wings strongly infumated. (pol) equalling (ool). Cell r2 only slightly higher than cell sc. .... **fumigatus (Klug)**

15 (14) Wings paler at base, almost hyaline, infumated towards apex. (pol) longer than (ool). Cell r2 twice as high as cell sc. Cu of fore wing not reaching apical margin. Comb spines distinctly widened towards apex. .... **cf. sabulicola spec. nov.**

16 (13) Joint 3 of antennae subequal to 1+2 (16).

17 (23) Comb spines of anterior metatarsus yellowish, the apical spine surpassing the 2nd tarsal joint. Apical tarsal joint with some inferior spines. Wings more or less hyaline, slightly milky, with dark apical margin. Vein Cut1 very little oblique.

19 (22) Third antennal joint subequal to joints 1 and 2 combined.

20 (21) Head, thorax and propodeum with long, raised, dorsal pilosity. (pol) : (ool) = 3:4. Length 9-11 mm. (Tripolitania, Cyrenaica). .... cf. *berlandi* Haupt

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(15) cf. *Telostegus major* Costa (1881) ; Haupt, Mon. Psamm., 1927, p. 269; idem, *Mitt. Zool. Mus. Berlin*, XVI, 1930, p. 707. — This Mediterranean species, unknown to me, comes very close to *melanurus* Klug, and must, therefore, be very similar in many respects to *adulator* sp. n., too. From the description it seems to appear, however, that the wings are not hyaline and the tarsal and other spines dark, and I find no mention made of the length and shape of the postnotum as compared with that of *melanurus*, which is so characteristically obtusely angled in *adulator*.

(16) Very large specimens of *T. excisus* Hpt. have joint 3 a little longer than 1+2, but differ in having the nervulus (Cut1) strongly oblique, the clypeus distinctly incised at the middle, having a lower cell sc in comparison with cell r2, and have the apical tarsal joint without inferior spines.

21 (20) Only the temples below with some raised white hairs, thorax and propodeum without conspicuous erect hairs. (pol) much longer than (ool). Apical tergite with cuprous sheen. Cu of fore wing not reaching margin. Vein Cut1 vertical. Length 5.5-7 mm. .... **masrensis spec. nov.** (¹⁷)

22 (19) Antennal joint 3 somewhat longer than 1 and 2 combined. Head in front and prothorax in front and laterally with silvery pubescence. Comb spines decidedly widened towards apex. No inferior comb spines present. Cu of fore wing not reaching apical margin. Temples, in dorsal aspect, not so strongly oblique as in *excisus* and *masrensis*. Vein Cut1 less oblique. .... **cf. sabulicola spec. nov.**

23 (17) Comb spines dark or strongly shaded, as long as 2nd tarsal joint or little longer. Cu of fore wing reaching apical margin. *Cut1 strongly oblique.* Wings shaded at least from basal vein, seldom paler. Prothorax without whitish pubescence. Clypeus in front always incised at middle. Anterior metatarsus, besides the lateral comb spines, with 1-2 longer inferior comb spines. Apical tarsal joint without inferior spines. Length 6.5-10.5 mm. .... **excisus Haupt**

24 (6) Dorsal area of apical tergite of abdomen with more or less decumbent pubescence; if rubbed, the ground is shining, more or less slightly convex, not dull and not with rough sculpture and flattened.

25 (28) Abdominal segments I-III red. Wings hyaline, slightly milky, apex abruptly blackened, limitation of the apical darkening straight.

26 (27) Anterior metatarsus with four comb spines which are as long as the 2nd tarsal joint. Ocelli forming an obtuse angle. Length 10-11 mm. (Cyrenaica). .... cf. *vachali* Saund.

27 (26) 1st metatarsus with *three* comb spines that are longer than the 2nd tarsal joint. Position of ocelli rectangular. Vein Mt2 of hind wing not vertical below. Length 8 mm. .... **apicatus spec. nov.**

28 (25) The wholy body with black ground colour. Wings pale or shaded, with dark apical margin, i.e. with curved limitation of the apical shading.

29 (30) Metatarsus of fore leg with three (seldom 4) *short, slender,* pale comb spines which are shorter than the 2nd tarsal joint. Head, prothorax anteriorly, propodeum, bases of tergites I-III of abdomen and legs

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(¹⁷) Very similar to this species is *T. desertorum* Haupt (from Palestine). In it the head is at first cylindrical and then rounded so that the temples, in dorsal aspect, appear obtusely angled; (pol) somewhat shorter than (ool). Width of eye one-fourth of frons. Comb spines brown. Fine pubescence silvery. Wings nearly hyaline, with broadly blackened apices. Fore legs with long tarsal comb, metatarsus with three lateral comb spines, the apical of which being 1.5 times as long as the 2nd tarsal joint.

with silvery pubescence. Cells r not higher than cell sc; cell r2 longer than r1 and longer than sc. Mt2 of hind wing slightly curved. (pol) much longer than (ool). Fore tarsi and often the calcaria testaceous. Wings with slight milky opacity. .... **argyrellus (Klug)**

30 (29) Comb spines longer.

31 (32) Distance of hind ocelli shorter than that between hind ocelli and eyes (=3:4). Antennal joint 3 as long as 1+2. Head not narrowed immediately behind eyes. Postnotum half as long as postscutellum Wings slightly shaded with dark apical margin. . **nigritulus (Klug)**

32 (31) Distance of hind ocelli as long as or longer than that between hind ocelli and eyes. Antennal joint 3 somewhat longer than 1 and 2 combined.

33 (34) Head not narrowed immediately behind eyes, (pol) = (ool). Postnotum half as long as postscutellum, hind margin obtusely angled at middle. Rt1 rather strongly curved. (Palestine)... cf. *frontalis* Haupt

34 (33) Head narrowed right behind eyes. (pol) as long as or slightly longer than (ool).

35 (36) The whole wings strongly infumated. Cu of fore wing not reaching apical margin. Postnotum almost as long as the postscutellum, hind margin rounded. Cell r2 below as long as or longer than r1. .... **imitator spec. nov.**

36 (35) Wings almost hyaline at base, with dark apical margin. Cu of fore wing fully reaching margin. Head, temples and prothorax (anteriorly) with whitish grey pubescence and scarce pilosity. Tarsal comb, fore tarsi and calcaria of middle and hind legs testaceous. Fore tarsi with some inferior comb spines besides the lateral ones. .... **haupti spec. nov.** (18)

37 (5) Males.

38 (39) Fore tarsi incrassate, the apical joint distinctly so, joint 3 and 4 broader than long; pulvillus large, bilobed. Wings hyaline, with dark apical margin. .... **crassitarsis spec. nov.**

39 (38) Fore tarsi normal, slender.

40 (45) Wings hyaline, with slight milky white opacity, without dark apex.

41 (42) Outline of head, in frontal aspect, square with rounded angles. Propodeum not shining, finely transversely aciculated. (Cyrenaica) .... cf. *quadrus* Hpt.

42 (41) Outline of head normal.

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(18) This species I should have held to be *fumigatus* (Klug), if Haupt had not examined the type of Klug's *fumigatus*, and put it into the group having dull, bare apical tergite, whereas in *imitator* a dense, black decumbent pilosity of this segment is present.

43 (44) Cell sc large, not lower than cell r2. Genital plate below strongly convex, with a tuft of long hairs at apex. Wings reaching or slightly surpassing apex of abdomen. Antennae much longer. Parts of body with silvery grey pubescence. .... **argyrellus (Klug)**

44 (43) Cell sc much lower than cell r2. Genital plate longer, slender, parallel-sided, without longer hairs. Wings short, by far not reaching apex of abdomen. Antennae short. Body with brownish pubescence. .... **brevicornis spec. nov.**

45 (40) Wings hyaline (or slightly milky) with dark apical margin, or strongly infumated.

46 (49) Wings hyaline at base, somewhat milky, with dark apical margin. Vein Cut1 vertical. Cell r2 slightly or distinctly higher than cell sc. Head, prothorax and sides of body with pruinose, whitish grey pubescence. Metatarsus of fore leg with two short lateral, but without inferior, comb spines.

47 (48) Metatarsus with two dark lateral comb spines of about equal length. Antennal joint 3 distinctly more than twice as long as broad. .... **melanurus (Klug)**

48 (47) The two short comb spines of unequal length, the distal one twice as long as that situated beyond middle. Antennal 3 only twice as long as wide. .... **masrensis spec. nov.**

49 (46) Wings infumated (more or less) also at base, darker towards apex. Vein Cut1 (nervulus) distinctly oblique. Cell r2 almost twice as high as cell sc. Anterior metatarsus, besides the 2 (-3) short lateral comb spines with one inferior comb spine. Antennal 3 about twice as long as thick. Pronotum and sides of body with pruinose brown pubescence. .... **excisus Haupt** (19)

Subgenus Telostegus s. str.

Telostegus convexus spec. nov.

Female: 10 mm. — Black, legs and comb spines dark. Posterior orbits with a reddish line. The fine, pruinose pubescence of the body is brown, scarcely paler at the temples, the raised pilosity of the temples is dark, not white; frons with grey pubescence below, clypeus at most at base with paler, otherwise with brown, pubescence. Wings shaded, more strongly so towards apex, with broad blackish apical margin. Hind wings paler at base, strongly darkened at apex.

Frons below much broader than above, eyes distinctly emarginated within; the eye narrower than half of frons. Ocelli forming a slightly obtuse angle, (pol) scarcely longer than (ool). Temples, in lateral aspect, a little thicker than the eye. Clypeus not emarginated in front. Antennal 3 somewhat longer than 1 and 2 combined, 4 a little longer than 1. Hind margin of prothorax obtusely angled. *Thorax very strongly convex,* occupying (in profile) more than one-third of a circle, almost a semicircle; prothorax steeply declivous in front. Postnotum shining, about half as long as the postscutellum. Propodeum laterally with a few raised hairs, with median sulcus. Tergite VI black, with reddish apical margin, dull, *very* finely granulated. Calcar of hind tibiae two-thirds as long as the metatarsus. Apical joint of hind tarsi without spines on the under side. Metatarsus of fore leg with three dark lateral comb spines which are scarcely widened towards apex, and the last of which is as long or slightly longer than the 2nd tarsal joint; besides, there is a very short and a somewhat longer inferior comb spine present. Exterior upper edge of the fore tibiae with 3 small spines. In the fore wing, the 2nd radial cell is also below much shorter than cell r1; the 2nd abscissa of R is distinctly shorter than the 3rd; the cells r are much higher than cell sc; Cu of fore wing does not reach the margin. Mt2 of hind wing vertical upon Cu.

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(19) In this group most likely belong the yet unknown males of *imitator* and *fumigatus* which will probably show a vertical nervulus.

Male unknown.

Habitat: Oasis Kharga (Genàh), 14.iii.1934, leg. H. Priesner (coll. Min. Agric.).

Telostegus melanurus (Klug)

1834. *Pompilus melanurus* Klug, Symb. phys., pl. 39, fig. 10 (female).
1869. *Aporus semirufus* Taschenberg, *Zeit. ges. Naturw.,* XXXIV, p. 69 (doubtful synonymy).
1883. *Pompilus gredleri* Kohl, *D. Ent. Zeitschr.,* XXVII, p. 184, female, male.
1930. *Telostegus melanurus* Haupt, *Mitt. zool. Mus. Berlin,* XVI, p. 708, figs. 24 and 25 (male and female; further references).

Female: 8-10 mm. — With legs and antennae black, abdomen dull red, from segments III-IV onwards black. Head and pronotum, the latter at least laterally, with silvery grey pubescence, abdomen pruinosely grey-brownish pubescent. Wings hyaline at base, gradually slightly darkened towards apex, with broadly blackened apical margin ; also most of cell sc shaded. Comb spines of fore tarsi and spines and calcaria of tibiae dark.

The eye two-thirds as broad as half of frons; median sulcus of frons indicated. Ocelli large, forming an obtuse angle, (pol) little longer than (ool). Antennae slender, joint 3 distinctly longer than 1 and 2 combined, 4 as long as 1+2. Clypeus not emarginated anteriorly. Hind margin of prothorax obtusely angled. Postnotum almost as long as or slightly shorter than the postscutellum, *smooth, slightly arched at hind margin.* Propodeum about as long as broad. Apical tergite dull, flat, granulated, bare, dark. The larger calcar of the hind tibiae about three-fourths as long as the metatarsus. Fore metatarsus with three dark lateral comb spines which are at least as long as the 2nd tarsal joint; *comb spines on under side wanting;* ultimate tarsal joint without spines on the under side. Cell r2 of fore wing as long as cell sc, but noticeably higher; Cu of fore wing not reaching margin. *Vein Mt2 of hind wing slightly reflexed,* hook-like, at base.

Male: 6.5-8 mm. — Wholly black. Wings hyaline, apex blackened. Genital plate slightly convex longitudinally and transversely, somewhat impressed at base, narrowly rounded at apex, apical margin set with *short* stiff bristles, under side with few long hairs that are longer than in *T masrensis.* Metatarsus of fore leg with *two* dark comb spines that are subequal in length and a little longer than half of tarsal joint 2.

Habitat: The species is widely distributed; it was found in Tripolitania, Cyrenaica, Egypt, Sudan and Arabia. In this country it occurs near cultivations rather than in the desert, and is fairly common in the Fayoum.

Telostegus adulator spec. nov.

Female: 8.5 mm. — Comb spines of fore tarsus yellowish, spines and calcaria of the tibiae paler than in *melanurus.* Colour as in this species, but the wings paler, milky hyaline, only the margin broadly dark.

Antennal joint 3 shorter than in *melanurus,* only little longer than joints 1 and 2 combined. Besides the three lateral comb spines of the anterior metatarsus, there is behind the middle of the metatarsus an inferior comb spine present. The pruinose pubescence of the abdomen is somewhat paler. The postnotum is longer than the postscutellum, and is produced medianly like a spherical triangle, i.e. it is not, as in *melanurus,* forming an even arc at the posterior margin. Furthermore, vein Mt2 of the hind wing is not reflexed hook-like, but joins the vein Cu in a moderately strongly curved arc, being vertical only at the extreme base. The apical tergite of the abdomen is roughened like in *T. melanurus,* but with cupreous sheen, not dull black. In the venation of the wing I was unable to find further differences.

Habitat: 1 female, Wadi Digla, 7.vi.1929, leg. H. Priesner; 1 female, Kafr Farouk, 20.iv.1937, leg. Alfieri.

Telostegus sabulicola spec. nov.

(Fig. 29)

Female: Black, the two first abdominal segments with dusky reddish hind margin, and also laterally dusky redidsh transparent, but the abdomen may be entirely black. Thorax dorsally with brown pubescence, on the abdomen the pubescence appears greyish in some directions. Collar and fore margin of prothorax, propleurae and temples with whitish grey pubescence, temples, moreover, with long raised white pilosity; sides of the scutellum, the whole postscutellum with white, frons and clypeus with grey-white, pubescence. Propodeum only at the hind margin with whitish pubescence. Comb spines of fore tarsi yellowish. Wings only very slightly smoky, less strongly so than in *excisus,* the black apical margin more sharply defined; also the hind wings with dark apical and postero-marginal shade. Cell sc darkened, too.

Clypeus not emarginated in front. Antennal 3 distinctly longer than 1 and 2 united, joint 4 as long as this combination. (pol) longer than (ool). Frontal sulcus conspicuous. Postnotum half as long as postscutellum. Propodeum without median sulcus. Vein Cut1 interstitial, little oblique; Cu of fore wing does not reach the margin; cell r2 below a little longer than r1, at the exterior margin twice as high as cell sc; 3rd abscissa of R longer than 2nd. Vein Mt2 of hind wing hook-like, forming an acute angle with Cu. interiorly. Apical tergite dull, finely granulated, more finely than in *T. excisus.* Anterior metatarsus with three testaceous comb spines that are distinctly widened towards tip, the ultimate one much longer than the 2nd tarsal joint, reaching about the middle of the 3rd joint; *inferior comb spines wanting.* Ultimate tarsal joint with a distinct double row of fine spines on the under side.

Habitat: Gebel Asfar, iv., v., leg. Alfieri and Priesner.

I should have identified this species with *T. berlandi* Haupt, if the sculpture of the apical tergite were not finer than in *excisus.* Haupt states for *T. berlandi:* « Skulptur des letzten Tergites deutlich zu erkennen », for *excisus :* « Skulptur des letzten Tergites sehr fein ». The 3rd antennal joint of *T. sabulicola,* is, besides, decidedly longer than in *berlandi* (3rd antennal subequal to 1+2), and the abdomen shows reddish areas at base.

Telostegus fumigatus (Klug)

1834. *Pompilus fumigatus* Klug, Symb. phys, pl. 39, fig. 7 (female).
1930. *Telostegus fumigatus* Haupt, *Mitt. zool. Mus. Berlin,* XVI, p. 710 (female).

Haupt redescribed this species from the holotype of Klug. In translation this description runs as follows :

Female: « Length 10 mm. — Black; the fine pubescence covering the whole body has a brown and only on the lower face a silvery sheen. Raised pilosity on head and dorsum, as well as on the end of the abdomen and its under side, dark. Wings strongly blackened, with darker apex. Cell r2 trapezoidal, as long as cell sc and only slightly higher. Cut1 interstitial. Head flatly rounded behind eyes, temples half as thick as the eyes. Ocelli much obtusely angled, (pol) = (ool). Frons slightly convex. Sulcus inconspicuous, orbits shallowly emarginated in the middle, width of eye two-thirds of half of frons. Antennal 3 much longer than 1 and 2 combined, twice as long as 1, joint 4 as long as 1+2. Clypeus slightly convex, straight in front. Postnotum about as long as the postscutellum, hind margin forming a flat arc. Propodeum scarcely as long as broad, with indistinct median sulcus. Apical tergite distinctly aciculated dorsally. Legs with long spines, fore legs with long comb, metatarsus with three spines that are longer than the following joint. »

Male unknown.

Habitat: Egypt, Sakkara (« Saccaharam »), leg. Ehrenberg.

I have not seen any specimen of *Telostegus* that would agree with the above description.

Telostegus masrensis spec. nov.

Female: 5.5-7 mm. — Black. All spines of the legs more or less yellowish. Dorsum of body with brownish, frons and clypeus (excepting fore margin), temples and propodeum, at least in certain directions, with whitish to whitish grey, sides of body with grey, pubescence. Mandibles testaceous. *Wings* hyaline with milky opacity, and rather sharply defined dark apical margin, reaching, but not entering cell sc, not attaining cells r and m.

The eye about one-fourth of width of frons, frontal sulcus inconspicuous, (pol) much longer than (ool). Clypeus not emarginated. Antennal joint 3 as long as 1 and 2 combined, 4 as long as 1. Postnotum only half as long as the postscutellum. Propodeum with median sulcus that is widened at base, in large specimens also without sulcus. Apical tergite about triangular, finely granulated, with reddish-cupreous hue. Comb spines of metatarsus very long, pale, only three lateral ones and no inferior ones present; the ultimate comb spines of the metatarsus attaining apex of 3rd tarsal joint. Ultimate tarsal joint with under side spines that are quite inconspicuous in the male. Cell r2 below 1.5 times as long as cell r1; vein Cut1 interstitial, straight, *vertical;* Cu not reaching apical margin of wing. Vein Mt2 of hind wing reflexed, hook-like at apex, but vertical in the male ; vein Cut flat, forming with Cu a pointed angle.

Male: 6.5-7 mm. — Wings hyaline, with distinctly darkened apex. Head, prothorax and posterior portion of propodeum with silvery pubescence, while the scutum shows a brown, the abdomen a brown-grey pruinose pubescence. Cut1 of fore wing vertical, as in the female, but Mt2 of hind wing not reflexed. The genital plate is slightly convex in profile and bears some raised hairs; in dorsal aspect it is semi-elliptical at the apical margin.

Habitat: Uncommon. Mansuria, Abu Rowash, Kerdasa, Fayed (in coll. Alfieri, Priesner and Min. Agric.).

Telostegus excisus Haupt

1930. *Telostegus excisus* Haupt, *Mitt. zool. Mus. Berlin,* XVI, p. 712, fig. 27.

Female: 6.5-11 mm. — Black. The whole body and the legs with fine pruinose brown pubescence, only the frons anteriorly with grey pubescence (clypeus brown pubescent). Temples without whitish, but with a few dark. raised hairs. Mandibles ferruginous at middle. Wings only slightly infumated at base, the surroundings of the basal vein darker, the infumation increases towards apex, margin darkest; cell m3 distinctly paler than the other cells. Hind wings darkened at least at apex, slightly so at hind margin.

Clypeus in the middle of the fore margin distinctly and narrowly incised in all specimens I could examine. Eyes much narrower than half of frons. Ocelli forming an obtuse angle, (pol) little longer than (ool). Fore tibiae at the upper exterior margin with 2-3 fine spines; metatarsus with three lateral comb spines which are *fine and little widened,* the ultimate spine attaining the apex of the 2nd tarsal joint or slightly surpassing it; under side with usually one longer and one shorter comb spine; ultimate tarsal joint without a row of small spines on the under side. Fore wing having cell r2 below about as long as r1; the 2nd abscisa of R is shorter than the 3rd. Vein Cut1 (nervulus) *distinctly oblique;* Cu of fore wing attains the apical margin nearly or fully. Mt2 of hind wing vertical upon Cu; Cut slightly prefurcal, joining Cu in a pointed angle. Apical tergite of abdomen bare, flattened, dull, finely granulated, dark.

Male. — Coloration as in the female. Head on under side with a few raised black hairs. Antennal 3 longer than 2, but shorter than 1. Clypeus not excavated in front. Apical sternite (genital plate) only with very short bristles, not with raised hairs. Venation as in the female. Fore tarsi with 2-3 short comb spines and a well visible but short inferior comb spine.

From similar species with dark wings *excisus* is in the male sex recognizeable by the strongly oblique nervulus (Cut1) and the possession of a small inferior comb spine on the anterior metatarsus.

Habitat: It is one of the more common species; I have seen it from the following localities: Esbeth-el-Nakhl, Gebel Asfar, Wadi Digla, Meadi, Fayoum; Gebel Elba. (ii.-vi., v.)

Distribution: Egypt, Cyrenaica, Tripolitania.

Telostegus apicatus spec. nov.

From the other species, except *T. rachali* Saund., much differing, especially by the interiorly sharply defined apical darkening of the fore wing that leaves a very narrow apical margin hyaline, too.

Female: 8 mm. — Black, fore tarsi brownish; fore margin of clypeus and the three anterior abdominal segments *red,* tergite I black at base. Head and pronotum with silvery white pubescence, temples with erect white pilosity. Scutellum dorsally with some brownish shining pruinose pubescence.

Position of ocelli almost rectangular, (pol) somewhat longer than (ool). Clypeus in the middle of the anterior margin very slightly sinuated. Antennae slender, joint 3 longer than 1+2. Temples, in lateral aspect, somewhat less thick than half of the eye. Pronotum narrowed towards apex, hind margin obtusely excavated. Postnotum about half as long as postscutellum. Apical tergite with fine and dense pubescence. Nervulus (Cut1) of fore wing strongly oblique; Cu of fore and hind wing reaching apical margin; cell r2 somewhat higher than cell sc, veins Rt slightly curved; vein Cut of hind wing prefurcal, joining Cu at a slightly acute angle, like does Mt2. Longer calcar of hind tibiae two-thirds as long as the metatarsus. Apical joint of tarsi without rows of spines on under side.

Male unknown.

Habitat: 1 female, 11.vii. 1937, Fayoum, leg. H. Priesner.

I had formerly considered this species to be identical with *T. vachali* Saund.; the latter has, however, four comb spines of the metatarsus which are only as long as the following joint, and the vein Mt2 is vertical, moreover, the prothorax has a rather long white pilosity and the ocelli lie distinctly obtusely angled.

Telostegus argyrellus (Klug)

1834. *Pompilus argyrellus* Klug, Symb. phys., pl. 39, fig. 9 (female).
1930. *Telostegus argyrellus* Haupt, *Mitt. zool. Mus. Berlin,* XVI, p. 716, fig. 30 (female).

Female: 6.5-10 mm. — Black, with relatively abundant silvery pubescence that is visible particularly on the head, anteriorly on the prothorax, on the whole propodeum and on the base of the abdominal segments I-III. Wings somewhat milky white, apex more or less blackened, extreme apical margin in most cases slightly paler. *Fore tarsi testaceous to pale brown;* comb spines pale; spines of tibiae dark.

Head flattened nearly right behind eyes; the eye somewhat broader than one-fourth of frons. Ocelli forming an obtuse angle, (pol): (ool) = 3:4. Median sulcus of frons feeble. Antennal joint 3 as long as or scarcely longer than 1 and 2 combined, 4 as long as 1. Clypeus slightly rounded in front. Pronotum a little emarginated posteriorly, scarcely obtusely angled. Postnotum pointed in the middle of the hind margin, narrower than in other species, shorter than the postscutellum. Propodeum without longitudinal sulcus. Apical tergite of abdomen very finely punctured and pubescent. Fore legs with 3 (seldom 4) short, yellowish comb spines of the metatarsus, the last of which does not attain the apex of the 2nd tarsal joint; inferior comb spines wanting. In the narrow wings the cells r are long and slender, as is cell sc; Cu of fore wing reaches the apical margin, and vein Mt2 of the hind wing is not vertical upon Cu, but meets it at a pointed angle; Cut of hind wing curved, joining Cu at a pointed angle and being prefurcal. The longer calcar of the hind tibiae mostly two-thirds as long as the metatarsus. Apical joint of the tarsi without under side spines.

Male: 4-6 mm. — *Wings without dark apex,* uniformly slightly milky. Temples behind eyes for a very short bit parallel; (pol) = (ool) or longer. Genital plate slender, raised roof-like, elongate rhomboidal in outline when viewed from the side, apical half with semi-erect fine bristles.

Habitat: I saw more than 40 specimens of this species which is the most common one of the genus, and is widely distributed over Egypt, common in the desert valleys, in the Fayoum and at Fayed, and it also occurs in the Gebel Elba region.

NOTE: Haupt's *Telostegus leucopterus* (*Mitt. zool. Mus. Berlin,* XVI, 1930, p. 789, figs. 85 and 86) may be identical with the male of *T. argyrellus.*

Telostegus nigritulus (Klug)

1843. *Pompilus nigritulus* Klug, Symb. phys., pl. 39 (female).
1930. *Telostegus nigritulus* Haupt, *Mitt. zool. Mus. Berlin,* XVI, p. 717 (female).

Haupt redescribed this species from the holotype of Klug. In translation this description runs as follows:

Female: « Length 9 mm. — Black; anterior half of clypeus brownish. Pubescence brown, silvery only frons and the fore coxae. Head, anterior body and coxae are, besides, rather densely covered with longer whitish hairs; at the apex of the abdomen and on its under side a few longer bristles. Fore wings slightly infumated, hind wings paler; both wings with blackened apical margin, in the fore wings are also the outermost cells darkened. Cell r2 trapezoidal, as long as cell sc and somewhat higher, vein Rt1 slightly curved, Rt2 straight; the latter and vein Mt3 are distinctly paler. Nervulus (Cut1) interstitial. Head from the middle of the eyes broadly rounded, temples, in lateral aspect narrower than the eye (2:3). Ocelli rather large, forming an obtuse angle, (pol):(ool) = 3:4. Frons slightly convex, broad, with fine median sulcus, orbits parallel to beyond middle, then converging, the eye one-fourth of frons. Antennae comparatively short and thick, joint 3 equalling 1 and 2 combined, 4 as long as 1. Clypeus rather flat, fore margin very shallowly obtusely angled in the middle. Pronotum somewhat narrower than the head, rather short, hind margin forming an obtuse angle. Scutellum with a slight median impression posteriorly. Postnotum about half as long as the postscutellum, hind margin widened in a flat arc; dull.

Propodeum about as long as broad, without median sulcus. Apical tergite convex, finely pubescent. Fore legs with long tarsal comb, metatarsus with three comb spines that are as long as or slightly longer than joint 2. Male unknown ».

Habitat: Sakkara (leg. Ehrenberg).

Telostegus imitator spec. nov.

Female: 8-9.5 mm. — Black, comb spines testaceous with darker base. Pubescence grey only on frons and base of clypeus, otherwise, also on fore coxae and temples, brownish; raised hairs of temples brown. Fore and hind wings evenly and strongly infumated, nearly black.

Clypeus truncate in front, straight. Ocelli forming an obtuse angle, (pol) distinctly longer than (ool). Temples, in profile, well half as broad as the eye. Eye much narrower than half of frons. Antennal joint 3 distinctly longer than 1+2, joint 4 only slightly longer than 1. Convexity of the thorax as in *argyrellus*. Postnotum obtusely triangular in the middle of the hind margin, with median sulcus, as long as the postscutellum. Propodeum at the sides with fine, sparingly set, brown raised hairs. Apical abdominal tergite convex, with dense, decumbent black pubescence, but (if rubbed) shining and finely punctured. Vein Cut1 of fore wing nearly vertical, interstitial or slightly prefurcal ; cell sc lower than cell r2, the latter below somewhat longer or at least as long as r1 ; Cu of fore wing does not reach the apical margin. Mt2 of hind wing vertical upon Cu, even slightly reflexed. The longer calcar of the hind tibiae about two-thirds of the length of the metatarsus. Fore leg with three long lateral comb spines of the metatarsus, which are distinctly slightly flattened and widened and yellowish transparent, the ultimate spine about 1.5 times as long as the 2nd tarsal joint; lower comb spines wanting. Apical joint of middle and hind tarsi with row of extremely short small spines on the under side. The upper exterior margin of the fore tibiae bears 3-5 fine spines.

Habitat: Borgash, Mansuria, Fayoum, v.-vi. (leg. Mochi and Priesner).

I should have identified this species with *T. fumigatus* (Klug), if Haupt had not examined and described the type of the latter which has a dull and granulated apical abdominal tergite, while our species comes closer in this respect to *nigritulus* (Klug) from which it differs by the black wings, the longer 3rd antennal joint, the brown pubescence of the temples and fore coxae, and the distances between ocelli and eyes.

Telostegus haupti spec. nov.

Female: 8.5 mm. — Black, with brownish pruinose pubescence; only on the face, at the temples and on the anterior part of the pronotum with whitish grey pruinose pubescence. Comb spines of fore tarsi and calcaria of tibiae yellowish to brownish. Wings almost hyaline, with broad apical darkening that also fills cell sc.

Frons more than three times as broad as the eye, i.e. half of frons a little less than twice as broad as one eye. The orbits diverge slightly from the bottom, the emargination above is slight. Temples rather broad, the occiput is, however, in dorsal aspect right behind the eyes not parallel-sided but narrowed, though more convex than in *imitator;* in lateral aspect the temples are more than half as thick as the eyes. Ocelli in rectangular position, (pol) very little longer than (ool). Clypeus not incised at the fore margin, very slightly emarginated, paler in front, with brownish, basally whitish, pubescence. Antennal joint 3 as long as to slightly longer than 1 and 2 combined. Distance of eyes on vertex a little greater than the lengths of antennals 2 and 3 united. Temples and prothorax (anteriorly) with white raised hairs. Prothorax angularly excavated at hind margin. Postnotum nearly straight posteriorly, truncate, with median sulcus, about two-thirds as long as the postscutellum. Propodeum with a feeble sulcus at base. Apical tergite little convex, with dense, dark pubescence, not granulated. Anterior metatarsus with three towards tip somewhat dilated comb spines of which the last surpasses the 2nd tarsal joint and attains about the middle of the 3rd joint; there are at least two pairs of *very short* inferior comb spines present (two and two on the same plane). The major calcar of the hind tibiae is about three-fourths as long as the metatarsus. Apical tarsal joint bare on under side. Fore wings with Cut1 oblique, Rt1 strongly curved, Rt2 less so ; cell r2 almost twice as high as cell sc ; Cu attaining apical margin of wing; in the hind wing vein Mt2 is vertical on Cu; vein Cut slightly curved S-like, joining Cu by a pointed angle, prefurcal.

Habitat : I know only I female of this species, that was taken by me in April at Borgash.

I should have identified this spcies with *nigritulus* (Klug), if Haupt had not given a full description of the latter. The distance of the hind ocelli is shorter than that between hind ocelli and eyes, though the ocelli form an obtuse angle, in *nigritulus.* I should add that Haupt mentions in his important paper on the Pompilidae of Palestine that *nigritulus* has 4 comb spines of the metatarsus; this may be a lapsus calami since he ascribes 3 spines to this species in his original redescription of this species (*Mitt. zool. Mus. Berlin*, XVI, 1930, p. 718).

Telostegus crassitarsis spec. nov.

Male : 7.5 mm. — Black, the fine pruinose pubescence of the body is, also at the sides, brownish, and is greyish-white on the frons. Temples and sides of prothorax, vertex, propodeum posteriorly and tergite 1 with very fine erect white pilosity. Wings nearly hyaline, with rather straightly defined apical darkening that reaches only cell sc.

Eyes somewhat more than half as broad as half of frons. Temples, in lateral aspect, very narrow, about one-third as broad as the eye. Ocelli forming an obtuse angle, (pol) longer than (ool). Antennal joint 3 about twice as long as thick. Prothorax strongly narrowed towards apex, evenly convex lengthwise. Dorsum of thorax little convex. Postnotum in the middle about as long as the postscutellum, hind margin in the middle slightly pointed. Bases of cells r1 and r2 subequal, r2 almost twice as high as cell sc; Cu of fore wing not reaching margin. Fore tibiae slightly convex at the sides, *fore tarsi distinctly incrassate, particularly the ultimate joint* which is twice as thick as the metatarsus; 2nd to 4th tarsal joint shortened, 3rd and 4th broader than long, 4th distinctly bilobed. Metatarsus with two fine, short comb spines, of which the apical one far surpasses the 2nd tarsal joint but scarcely reaches the apex of the 3rd joint. Pulvillus very large, that of the fore tarsi distinctly bilobed. Anal sternites contracted, not visible.

Habitat: 1 male, Gebel Elba, Wadi Aideb, ii., leg. H. Priesner.

A remarkable species which owing to the formation of the fore tarsi cannot be confused with any other species hitherto described.

Telostegus brevicornis spec. nov.

Male: 5.5 mm. — Black, everywhere covered with fine pruinose brownish pubescence. Body without raised pilosity. Wings hyaline, with a slightly milky opacity, *without apical darkening.* Temples with a few white raised hairs.

The eye about as broad as one-fourth of the frons. Ocelli forming an obtuse angle, (pol) longer than (ool). Temples short, in lateral aspect about one-third as broad as the eye. *Antennae short,* about as long as thorax and propodeum combined, joint 3 only 1.5 times as long as broad. Prothorax strongly narrowed towards apex, hind margin obtusely angled. Thorax little convex. Postnotum about half as long as postscutellum. Propodeum with fine median sulcus. 1st abdominal segment, in lateral aspect, nearly flat. Anterior metatarsus with two comb spines, the much longer apical one of them not reaching the apex of the 2nd tarsal joint. In the fore wing is cell sc much closer to the apical margin than cell r2; cell r1 below subequal in length to r2, but above distinctly shorter than the latter; cell r2 somewhat higher than sc; Cut1 prefurcal, *vertical.* Genital plate slender, narrowed towards apex, narrowly rounded at apex where it bears *short* rigid bristles; lower surface flat in profile, without raised hairs.

Habitat: One male, Mansuriah, vi., leg. H. Priesner.

This form is distinguished from all hitherto known males by the short antennae and wings, from that of *argyrellus* with which it agrees in having wholly pale wings it differs, besides, by the brown pubescence of the propodeum and other parts of the body. From Haupt's species *T. quadrus* it can be separated by the difference in the shape of the head, and from *leucopterus* (which may be identical with *argyrellus*) by the structure of the genital plate.

Subgenus Telostegoides nov.

Like *Telostegus* s.str., but antennae slightly serrate, i.e. the segments from the 4th onwards are obtusely axe-shaped and are inserted above only, as this is the case in some *Claveliinae* (cf. Arnold, Psamm. ethiop. Reg., pt. II, p. 84, fig. 23 a).

Telostegoides lacteipennis spec. nov.

Male: 7 mm. — Black, inclusive of legs and antennae; body not very densely clothed with fine, white-grey pruinose pubescence which becomes longer at the sides of the body and on the propodeum, but remains decumbent. Wings with milky white opacity, Co and Sc yellow, the other veins and the pterostigma brownish, the veins becoming darker towards apex of wing which remains pale on the blade.

Head comparatively small, much narrower than the thorax, shining, of roundish outline. The eye almost only one-fourth of the width of the frons, or at least half of frons 1.5 times as broad as the eye. Genae long, clypeus by far not attaining the eyes, narrower than the frons below, short, sides much narrowed towards apex, anterior margin truncate, surface little convex, densely and finely punctured. Ocelli forming a large obtuse angle, (pol) twice as long as (ool). Temples short, at most one-third of the width of the eye, in lateral aspect. Antennae about as long as head+thorax, serrate, joint 1 short, slightly curved; joint 2 transverse, very short; each joint from 4th onwards inserted only on one side (as in some males of *Paraclavelia* and *Parapompilus*), the joints very slightly concave above, sligtly axe-shaped: ultimate joint conical, obliquely truncate at apex. Prothorax rather long, though somewhat broader than long, broadest posteriorly, slightly convex in anterior half, hind margin slightly incised in the middle. In lateral aspect the prothorax is strongly convex but not quite vertical in front. Scutum flattened, not reflexed at the sides, notauli fine. Scutellum triangular, flattened. Postnotum smooth, somewhat shorter than the postscutellum. Propodeum normal, finely sculptured and with fine median sulcus. Abdomen slender, lanceolate; genital plate slender, with broad median keel and dense short pilosity. Wings *narrow,* stigma well developed but narrow, much more than half as long as the fore margin of cell sc; the latter very narrow, somewhat lower than cell r2; 1st and 2nd abscissa of R subequal, short, 3rd well five times as long as 1st or 2nd; *basal vein strongly curved;* vein Rt1 curved, Rt2 less so; Cu of fore wing reaches almost fully the apical margin of the wing; Cut1 vertical, somewhat curved, slightly postfurcal; vein Mt3 interstitial, Mt2 ending proximal to 1st third of cell r2; cell m3 somewhat pointed at the proximal basal angle. Hind wing with long, slender, separated basal lobe; Rt3 half as long as the 1st abscissa of R; Cut strongltу oblique at apex, strongly prefurcal. Fore tibiae short, about as long as 1st and 2nd tarsal joints combined, fore tarsi comparatively short, joint 4 not longer than wide, preening organ on the under side of the metatarsus occupying half of the length of the latter. Apical joint of hind tarsi without under side spines. Hind femora with some short preapical spines, fore tibiae without noticeable upper exterior spines. Hind tibiae with several rows of short spines that originate from the base of elongate foveolae; calcaria long, the major one two-thirds to three-fourths of the length of the metatarsus, in the hind legs. Pulvillus slender but more than half as long as the claws. The latter distinctly bifid, but the inner branch very short.

Habitat: 1 male, Borgash, 25.iv.1934, leg. H. Priesner.

That this insect belongs near *Telostegus* and, in spite of the serrate antennae, not to the subfamily *Claveliinae* is proved by the possession of splayed out spines at the apex of the tibiae, and the pointed cell m3 of the fore wing.

III. Tribe Psammoderini Arnold

Genus PARAFERREOLA Sustera

1912. *Paraferreola* Sustera, *Verh. zool. bot. Ges. Wien,* p. 200.
1927. *Paraferreola* Haupt, Psamm. Europas, p. 271.
1925. *Paraferreola* Arnold, Psamm. Ethiop. Reg., pt. IV, p. 438.
Paraferreola Haupt, Pompiliden Palästinas, MS.

Three radial cells. Cell m3 distinctly or only slightly pointed at the proximal basal angle. Orbits diverging towards vertex. Antennae comparatively short and stout. Vertex somewhat raised between the posterior ocelli. Propodeum having horizontal and posterior portion distinctly separated, the lateral margins of the latter with blunt projections or lobes. Fore tarsi with extremely short comb spines on metatarsus. Calcaria short. Claws dentate in the female, bifid in the male. Mandibles bidentate. Abdominal sternite II without transverse depression.

Paraferreola anomala Haupt

(*Paraferreola anomala* Haupt, Pompil. Palästinas, MS)

Female: 9.5 mm. — Wholly black, with very fine, pruinose, dark pubescence. Wings evenly and distinctly infumated.

Legs and antennae comparatively short and stout, joint 3 of the latter at least as long as 1 and 2 combined. Frons strongly convex, head in frontal aspect somewhat transverse, frons three times as broad as the eye. Ocelli forming an obtuse angle, each lying in a small fovea. Temples, in lateral aspect, narrow. Clypeus convex, with distinct emargination of the fore margin. Pronotum parallel-sided, abruptly narrowed near fore margin. Suture between scutum and scutellum vestigial. Propodeum strongly declivous posteriorly and excavated, with bluntly dentate hind angles and a small callus in front of these teeth; a small fovea in front of the callus. Abdomen elongate. Apical tergite bare. Cell r2 below distinctly shorter than r3, above longer than the latter, cell r3 strongly narrowed anteriorly, above nearly only one-third as long as below, vein Rt3 strongly curved or broken. Nervulus slightly postfurcal; Cu of fore wing ending far from apical margin. Vein Cut of hind wing strongly curved at apex, vertical upon Cu and postfurcal. Fore tarsi short, fore tibiae practically spineless, metatarsus with very small spines which are shorter than the apical width of the metatarsus. Spines of the stout hind tibiae sparse, nearly decumbent. Tarsi dentate.

Habitat: 1 female, Ikingi (Mariout), 8.viii.1934, leg. Rabinovitch (coll. Alfieri).

I identified this specimen with *P. anomala* Haupt (Palestine) although it differs from it in having a conspicuous sulcus on the propodeum, wanting in *anomola*, and in the lack of a distinct transverse sculpture of the propodeum, while *anomala* shows transverse striae. From other species of the genus, *anomala* is distinguished by the shape of the propodeal teeth and the uniformly black colour of the body.

Haupt describes the male, too, and says that it varies greatly in size (5-11 mm.). Black, with 2 red spots on the base of the 2nd abdominal tergite, and 2 spots of grey pubescence on the 3rd tergite. Tergite VII white. Propodeum in perfect specimens with silvery pubescence. Wings hyaline. Cut1 of fore wing and Cut of hind wing interstitial. Sides of the propodeum posteriorly with an inconspicuous tooth.

IV. Tribe Platyderini Arnold

Genus PLATYDERES Guérin

1927. *Platyderes* Haupt, Psamm. Europas, p. 285.
1935. *Platyderes* Arnold, Psamm. Ethiop. Reg., pt. IV, p. 450.
Platyderes Haupt, Pompil. Palästinas, MS. (key).

Three radial cells. Transverse anal vein (Cut) of hind wing ending vertically or mostly slightly reflexed. Mandibles tridentate. Clypeus large, more or less flattened, fore margin strongly convex. Eyes slender. Pronotum strongly narrowed towards apex, sometimes even concave at sides, hind angles much produced posteriorly. Scutellum and scutum flat. Propodeum excavated at the declivity, with lateral projections or teeth. Fore tarsi without comb. Claws bifid in both sexes. Sternite II of abdomen with a distinct transverse depression.

In this genus the males are less easily distinguished from the females, since the genital plate is sometimes pointed and folded. The antennae of the males are always shorter, not involute, joint 3 being at most twice as long as broad, while it is three to five times as much in the females. The head of the male is smaller than that of the female.

Key to Egyptian species

1 (2) Slender form having comparatively small head. Prothorax long, sides concave. Head and propodeum black; abdomen on segments I-III with broad basal fascia of silvery grey tomentum, otherwise black. Propodeum with silky-grey pubescence, declivity with coarse longitudinal wrinkles. Fore wing hyaline about basal half, with dark veins, apical half strongly infumated. Legs and antennae black. .... **elegans spec. nov.**

2 (1) Head broader, pronotum shorter. Wings strongly infumated, sometimes with metallic lustre. Abdomen seldom with grey fasciae. Propodeum not distinctly grey.

3 (4) Propodeum dusky red. Legs ferruginous, hind coxae red, tarsi dark brown. .... cf. *clypeatus* (Klug)

4 (3) Propodeum black.

5 (12) At least the prothorax partly orange, ferruginous or dusky ferruginous.

6 (7) Very small species (6-7 mm.), having both orbits, margin of vertex, prothorax (with broad dark basal spot) brown or dusky ferruginous, scutum and scutellum brownish black, the former with red posterior margin, abdomen black, legs dusky red to black. Genae conspicuous. (pol):(ool) = 7:5.5. Cell r3 nearly closed anteriorly; Mt2 prefurcal Propodeum on the declivity shortly and broadly excavated, with median carina. .... **pygmaeus spec. nov.** (20)

7 (6) Larger species of other coloration.

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(20) In the similar *P. parvulus* Haupt (Palestine) the distance of the hind ocelli in comparison to that between ocelli and eyes is 3:4, and the 1st recurrent vein (Mt2) is interstitial.

8 (9) Anterior body flavo-ferruginous. Tergites II and III of abdomen at base with a faint pale grey fascia of tomentum. Cell r2 above somewhat shorter than r2. Legs black. Clypeus comparatively short and broad, slightly convex, rounded in front. ...... **dimidiatus (Lind.)** (21)

9 (8) Anterior body dark orange or ferruginous. Abdomen wholly black, with more or less brown to violet pubescence, without grey fasciae. Cell r3 narrow above, where it is only one-third or less as long as cell r2.

10 (11) Legs ferruginous; coxae, trochanters, extreme base of femora and middle and hind tarsi black. Postscutellum black. The black spot on the frons isolated. Calcar of hind tibiae scarcely half as long as the metatarsus. Antennae of female red at base, of male joint 1 darkened, but flagellum red beneath. .... **divisus (Walk.)**

11 (10) Legs and antennae black. Postscutellum mostly reddish. The dark spot on frons touches the eyes. Calcar of hind tibiae slightly more than half as long as the metatarsus. .... **sagax Kohl**

12 (5) Body and legs black, only the head partly reddish. Pubescence of abdomen with violet sheen. .... **carbonarius (Walk.)**

Platyderes elegans spec. nov.

Female : 9-15 mm. — Black; prothorax, scutum, tegulae and the upper portion of the scutellum flavo-ferruginous, tip of scutellum sometimes darkened. Legs and antennae black, palpi yellowish, dark exteriorly. *Fore and hind wing hyaline at base,* with dark veins, about from the basal vein onwards more or less strongly infumated with darker apical margin, the dark parts with blue lustre. Head (in certain direction), propodeum, legs, basal half of tergite I, a basal fascia on segment II and a narrower one on tergite III, with pale grey to silvery pubescence; of the sternites, I, II and III show grey pubescence, but sternite II is black at hind margin, more narrowly so in the middle. The black portions of the tergites on dorsum with violet sheen.

Slender species, somewhat reminding of a *Homonotus*. Head flattened, clypeus evenly rounded, depressed at base, covering the mandibles, not quite reaching the eyes laterally, but the genae short. Eyes strongly emarginated within, their width equalling about one-third of the width of the frons. The ocelli, being situated each in a small fovea, forming an obtuse angle, (pol) about equalling (ool). Temples, in lateral aspect, scarcely more than half as thick as the eyes. In dorsal aspect the temples are angularly rounded.

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(21) *P. algirus* (Lep.) of South-western Europe and Western North Africa, being similar in colour, has longer, trapezoidal, plate-like clypeus and darker frons and clypeus.

Antennae short, joint 3 subequal to 1+2, joint 4 as long as 1. Prothorax long, bell-shaped, i.e. sides concave posteriorly about as broad as the head, hind angles produced, hind margin slightly sinuated. Notauli slightly converging posteriorly. Scutellum flat, truncate behind, postscutellum scarcely deeper. Postnotum hardly visible. *Propodeum strongly narrowed towards apex*, flat, slightly convex, declivity not sharply margined above, somewhat excavated in the middle, with coarse longitudinal striae, hind angles conspicuous, about rectangular. Abdomen slender, segment I somewhat longer than broad, II about as long as broad, apical segments with *short* bristles at the sides. Wings with basalis slightly curved, Cut1 interstitial; longitudinal veins ending far from apical margin; veins Rt1 and Rt2 oblique, the former and Rt3 (more or less) curved; cell r3 narrow above, less than half as long as r2, and one-fourth as long as below, where it is much longer than r2. Vein Cut of hind wing strongly semicircularly curved at apex, forming a right angle with Cu, interstitial. Fore tibiae and tarsi short, joint 1 about as long as 2 to 4 combined, without comb spines. Hind tibiae densely set with unevenly placed moderately long spines, calcar as long as or longer than half of the metatarsus; apical tarsal joint without spines on the under side. Claws bifid, pulvillus slender, half as long as claws, with few short comb bristles.

Male: Very similar, smaller.

This species comes no doubt very close to *P. dregii* Brauns, particularly to the variety having ferruginous scutum and scutellum (cf. Arnold, Psamm. Ethiop. Reg., pt. IV, p. 459; 1935), but it cannot be identical with it, as the frons of *elegans* is not five times as broad as the eye but only three times, and therefore is also the distance of the eyes on the vertex not longer than the 2nd to 4th antennal joints combined. The scutellum of *elegans* is straight posteriorly, truncate, the 1st abdominal segment is somewhat longer than broad and vein Cut of the hind wing is interstitial.

Habitat: In the collection of the Ministry of Agriculture there is a score of specimens of this remarkable species, cóllected from Kafr Hakeem, Borgash, Mit Ghamr and Helouan (ii., viii-xi.). I found a single male at Abu Roash.

Platyderes clypeatus (Klug)

1834. *Pompilus clypeatus* Klug, Symb. phys., pl. 39, fig. 14.
1926. *Platyderes clypeatus* Haupt, Psamm. Europas, p. 285.

Original description (translated) : « With 3 submarginal cells of the fore wing, claws bifid, clypeus covering the mandibles, metathorax excavated posteriorly. Yellow, abdomen and elytra black. — Patria : Ambukohl, in August. — Near to *P. coccineus* F., of its size, clypeus very large, covering the mandibles and thus differing from all species. Head flattened, smooth, testaceous, tip of mandibles and eyes black. Thorax testaceous, scarcely whitish pruinose, propodeum broadly and deeply excavated posteriorly, dark red. Legs testaceous, hind coxae sanguineous, tarsi dark brown, tibiae scarcely spinose, spines dark. Wings blackish, veins and stigma black. Abdomen brown-black. Perhaps a proper genus. Length 14 mm. ».

I quoted the original description by Klug since Walker (List of Hym. coll. by Lord in Egypt, London, 1871, p. 15) mentioned this species from Cairo and Tor. I suspect faulty identification by Walker, as this insect has not been found since, in Egypt.

Platyderes dimidiatus (Lind.)

1926. *Platyderes dimidiatus* Haupt, Psamm. Europas, p. 285.
Platyderes dimidiatus Haupt, Pomp. Palästinas, MS.

Male: Head, pronotum, scutum and dorsal portion of scutellum flavoferruginous or pale orange, dull, with fine, pruinose, white pubescence; frons with black spot that is divided in the middle; another black transverse spot at the base of the scutum behind the prothorax. Propodeum, sides of the scutellum, postscutellum, antennae, legs and abdomen black, the latter with greyish pubescence on the base of tergites II and III. Wings smoky, without blue lustre.

Clypeus short and broad, rounded in front. Genae three times as broad as long in the middle. Temples behind eyes shortly cylindrical but narrower than the vertex across eyes. Propodeum at the declivity with a slender triangular elevation, posteriorly. Fore wing with r2 subequal to r3 below, r3 somewhat more strongly narrowed than r2, anteriorly. Genital plate elongate, carina straight in profile. Vein Cut1 interstitial; vein Cut of hind wing reflexed at apex, slightly prefurcal.

Habitat: 1 male, Nouzha gardens, 10.vii.1918, leg. Alfieri.

Distribution: Aegina, Asia minor, Palestine, Egypt.

This species might only be confused with *P. algirus* Lep. of south-western Europe and western North Africa, but differs particularly in having a less flattened, shorter, not really trapezoidal clypeus, distally slightly widened vertex, longer genae and darker frons and clypeus.

Platyderes sagax (Kohl)

1886. *Pompilus sagax* Kohl, *Verh. zool. bot. Ges. Wien,* XXXVI, pp. 307 and 323.
— *Platyderes sagax* Haupt, Pomp. Palästinas, MS.

Female: 13-16 mm. — Similar to *divisus* but at once distinguished by the black legs and antennae and (in the female) by the larger black spot on the frons. Head, pronotum, scutum and scutellum and sometimes also the postscutellum ferruginous, rest of the body black. Wings blackish brown, with violet lustre.

Head across the temples not broader than across the eyes. Clypeus large, narrowed anteriorly, slightly emarginated in front and convex lengthwise. (pol) nearly equalling (ool). Declivity of propodeum short. Cells r2 and r3 below subequal in length, r3 nearly triangular or closed above. Last joint of hind tarsi with conspicuous spines on the under side (that are wanting in the male).

Male: 8-12 mm. — The red coloration of the smaller head is confined to the orbits and the occiput. Antennae and legs black. Otherwise very similar to the male of *divisus*.

Habitat: The species seems to be widely distributed over North Africa, is common in Palestine, but like many other species in common with other countries it is more seldom in Egypt. I found a single male (v. 1940) at the sea shore near Abukir, east of Alexandria.

Platyderes divisus (Walker)

1871. *Ferreola divisa* Walker, List of Hym. coll. Lord Egypt, London, p. 17 (male).

Description by Walker: « Male. — Deep black. Head red; a black spot on the vertex including the ocelli. Eyes black, fusiform. Antennae black; first and second joints red. Thorax red. Prothorax with gilded tomentum. Fore border of the scutum of the mesothorax with a blackish abbreviated band which emits two piceous longitudinal streaks; scutellum elongate-conical, slightly notched and truncate at the tip. Mesothorax black. Legs red; coxae, trochanters, four posterior femora at the base, four posterior tibiae and four posterior tarsi black. Wings bluish black; veins black; tegulae red. Length of the body 6 lines. ».

The above description fully agrees with that given below, based upon the specimens collected by me at the Red Sea coast and at Gebel Elba, except for the coloration of the four posterior tibiae which are ferruginous in all my specimens.

Female: 11.5-17.5 mm. — Anterior body ferruginous, middle of prosternum, the meso- and metasternum, the postscutellum, propodeum and abdomen black; pronotum, mesonotum (sometimes slightly blackened at base), scutellum and tegulae ferruginous; head with black ocellar spot that never reaches the eyes, clypeus more or less blackened only at the base. Antennal joint 1 always red, joints 2 and 3 sometimes so. Coxae and trochanters black, base of middle and hind femora narrowly blackened, the rest of the femora and tibiae and the fore tarsi ferruginous, middle and hind tarsi more or less blackened. Pubescence of abdomen mostly with bluish sheen. Wings strongly infumated, more or less with blue lustre.

Clypeus about as in *P. sagax,* strongly produced, slightly emarginated in front. Temples in larger specimens slightly widened posteriorly, broader than the eyes, in medium-sized specimens parallel-sided, in small ones narrower than the eyes. Thorax as in *P. sagax,* notauli less deeply incised, fading out anteriorly. Propodeum in the middle not or less distinctly sulcate, or only posteriorly sulcate, and sometimes with a slight incision right in front of the declivous portion, not pointed in this region. Surface of declivity smooth. Longer calcar of hind tibiae only half as long as the metatarsus; the double row of spines on the under side of the ultimate tarsal joint is conspicuous, but nearly wanting in the male.

Male: 9.5 mm. — Coloration similar, but antennal 1 dark, joints 2-4 dark reddish, the remaining joints reddened beneath. Base of scutellum distinctly blackened. Middle and hind femora dark in basal half, middle and hind tibiae blackened at apex, middle and hind tarsi black, fore legs red. Clypeus black, head with large black spot that leaves only the orbits and the temples red.

Habitat: Walker's types are from Hor Tamanib (Red Sea coast) and Tajura (Straits of Bab-el-Mandeb). I saw specimens in the collection of the Ministry of Agriculture from Mersa Halaib (ii. and iii., 1938) and have myself a specimen from the Bir Abrag, all from the Red Sea coast.

Platyderes carbonarius (Walker)

1871. *Ferreola carbonaria* Walker, List of Hym. coll. Lord, London, p. 17.

Original description : « Male. — Deep black. Head dark red about the eyes and along the hind border. Eyes piceous, fusiform. Prothorax with a large dark red patch on each side. Wings bluish black; veins black. Length of the body 6 lines. — Mount Sinai. »

Female: 11 mm. — Black, vertex, genae, temples and the inner orbits dark red, on the prothorax only the lateral margin reddish (in Walker's male the prothorax has a red lateral spot). Antennae and legs black, palpi dark brown, mandibles ferruginous. Fore wings strongly infumated, with bluish lustre.

Head flattened, antennae situated on an elevation that is steeply declivous to the clypeus which fully covers the mandibles. Head and clypeus dull, only the fine anterior margin of the latter shining. Genae long, clypeus not reaching the eyes, slightly narrowed and rounded laterally, truncate in front, as a whole, scarcely more than 1.5 times as broad as long. Orbits interiorly towards vertex very slightly emarginated; width of eye only about one-fourth of frons; vertex somewhat produced behind eyes; temples, in lateral aspect, well half as broad as the eye; ocelli forming an obtuse angle, (pol) = (ool). Frons without median sulcus. Antennal joint 3 little longer than 1+2.

Prothorax long, sides straight, or indistinctly concave, strongly narrowed towards apex; hind margin of prothorax with three slight excavations. Scutellum and postscutellum flattened, postnotum not visible. Propodeum with feeble and very short basal sulcus, declivity excavated, sharp-edged in front, sides with blunt tooth, interiorly with quite indistinct longitudinal striation. Thorax and abdomen clothed with a shining brownish tomentum. Vein Rt1 semicircularly curved, Rt2 straight, slightly oblique, Rt3 curved; cell r3 almost closed above, at most one-third as long as cell r2, below about as long as the latter; vein Mt2 not quite interstitial with Rt2. Vein Cut of hind wing semicircularly curved, prefurcal. Cu of fore wing does not reach the margin; nervulus (Cut1) curved, scarcely prefurcal. Longer calcar of hind tibiae about half as long as the metatarsus. Pulvillus small and slender.

Habitat: 1 male, Wadi Hof, 1.iv.1922, leg. Chakour (coll. Alfieri). Walker's type originates from Mount Sinai.

Platyderes pygmaeus spec. nov.

Male: 6-6.5 mm. — Black with brownish pruinose pubescence, head with orbits and hind margin of vertex red, antennal joints 1 and 2 dark brown-red, prothorax brown-red with transverse dark anterior spot so that the sides and the hind margin remain broadly red. Thorax and propodeum dark, only the scutum broadly reddened posteriorly. Fore legs red-brown, middle and hind legs almost blackish, femora dark red transparent. Wings evenly shaded with brown.

Frons, in lateral aspect, strongly convex, antennae resting on a blunt elevation, in front of the antennae a transverse furrow. Clypeus large, margin strongly narrowed towards apex, fore margin truncate. Genae as long as the 2nd antennal joint. Eyes emarginated within, one eye about one-fourth of width of frons. Temples, in lateral aspect, scarcely more than one-third as thick as the eye. Ocelli forming an obtuse angle, (pol) somewhat longer than (ool) = 7:5.5 (22). Temples, in vertical view, not longer than antennal 2; occiput abruptly declivous. Antennae comparatively long and slender, joint 3 well twice as long as 2, as long as or scarcely longer than 1, scarcely twice as long as broad, 4 or 5 only little longer than 3. Prothorax strongly narrowed towards apex, sides slightly concave, hind margin nearly straight, slightly undulating, *hind angles strongly produced posteriorly, lobiform*. Scutellum broad, flat. Propodeum slightly declivous, the horizontal part nearly longer than the declivity, that is excavated and limited anteriorly by a blunt edge; hind angles slightly protruding; *declivity coarsely chagreened* (in the similar species *P. parvulus* Haupt the declivity is smooth). Abdomen as long as the thorax (+propodeum). Genital plate slender, compressed laterally, finely and shortly black pilose, apex with a tuft of short hairs. The upper part of the basal vein (M) is curved below, vein Cut1 is interstitial, little oblique. Pterostigma conspicuous. Cell sc higher than the cells r, veins Rt1 and Rt3 curved; cell r3 below scarcely shorter than r2, *almost closed above ;* 1st abscissa of R scarcely half as long as 2nd, 3rd hardly visible. Vein Cut of hind wing rectangular upon Cu, slightly prefurcal. Metatarsus of fore leg a little longer than the joints 2-4 combined, Pulvillus small, slender. The longer calcar of the hind tibiae one-half to two-thirds as long as the metatarsus.

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(22) In *Platyderes parvulus* Haupt (from Palestine) is (pol):(ool) = 3:4.

Female unknown.

Habitat: 1 male, Wadi Hof, 25.vii.1922, leg. Alfieri.

V. Tribe Pseudopompilini Arnold

Genus PSEUDOPOMPILUS Costa

Body heavy and comparatively short, head small, occiput concave, sharply margined. Ocelli forming a flat obtuse angle. Sides of pronotum convergent anteriorly. Horizontal part of propodeum short, declivity very strongly excavated, with stout hind angles which surround the 1st abdominal segment. Propodeum with very dense, and to the rest of the body strongly contrasting, pile of silvery hairs. Cell m3 of fore wing pointed at the proximal basal angle. Transverse anal vein (Cut) of hind wing strongly curved and reflexed at apex. Three radial cells present.

Pseudopompilus humboldti (Dahlbom)

1812. Unnamed, Savigny, Descr. d'Egypte, pl. 18, figs. 21 and 22.
1927. *Pseudopompilus humboldti* Haupt, Mon. Psamm., p. 293, fig. 145.

Female: 12-15 mm. — Black, segments I-III of the abdomen dull, dark red, base of I somewhat black. Propodeum *densely* clothed with much contrasting silvery pubescence. Prothorax in front with brownish grey, behind with brownish pubescence; head anteriorly, thorax and coxae beneath with silvery pubescence. Basal third of wing hyaline, rest dark brown with violet lustre.

Vertex rather sharply margined, slightly and obtusely emarginated behind. Position of ocelli very strongly obtusely angled, (pol) shorter than (ool). Eyes converging towards vertex, emargination situated in the upper third. Clypeus convex, emarginated in front. Antennal joint 3 little longer than the silvery joints 1 and 2 combined. Temples, in lateral aspect, widened below. Prothorax very strongly narrowed towards apex. Scutellum flattened. Postnotum concealed. Propodeum evenly emarginated behind, its posterior angles surrounding the base of the 1st tergite. End of abdomen without conspicuous pilosity. Nervulus (Cut1) oblique, interstitial; 1st abscissa of R as long as 3rd, 2nd almost twice as long; vein Rt1 almost broken, Rt2 vertical, Rt3 oblique, little curved. Vein Cut of hind wing very much curved at apex, somewhat reflexed, nearly interstitial. Pulvillus very large, oval. Spines on tarsi very short, last joint of tarsi without spines on the underside. Spines on apex of tibiae short, not splayed out.

Male. — In the male the silvery clothing of the propodeum is better developed, and also the tergite I and the posterior margin of the tergites II and III show lateral transverse bands in front of the hind angles, the tergite IV has a silvery band in anterior half. Wings with dark, shining blue, transverse fascia, the apex of the wing remaining pale. The male of this species differs, according to Haupt, from that of *P. antonini* Dest. (from Sicily) particularly in that cell r3 is above less than half as long as r2, and the 2nd recurrent vein (Mt3) ends at the middle of cell r3, not behind it.

Habitat: Rare in Egypt. I saw two females from Suez (VII.), leg. Storey (coll. Min. Agric.).

VI. Subfamily HOMONOTINAE Haupt

Genus HOMONOTUS Dahlbom

Three (seldom two) radial cells. Basal vein (M+Mt1) usually angulated; the second abscissa of sc formed by the end of the basal vein only one-fourth as long as the first. Transverse anal vein (Cut) of hind wing short, straight and nearly vertical, prefurcal. Antennae short and stout, inserted at the declivity of a frontal callus. Body slender, surface shining, *punctured*, pubescence scarce. Head much convex, forming a sort of cap resting upon the prothorax, and having a trenchant edge on the vertex. Pronotum cylindrical or (male) slightly conical. Propodeum only slightly and gradually declivous, its posterior angles more or less dentiform. Abdomen slender, broadly attached to the propodeum, apical sternite of female compressed. Claws bifid in both sexes.

Key to Egyptian species

1 (2) Anterior body and the first two abdominal segments black, apex of abdomen red. Length 8-9 mm.................. **aegyptiacus (Rad.)**

2 (1) Head, thorax and propodeum pale ferruginous, abdomen black. Length about 5 mm. .... **semiflavus spec. nov.**

Homonotus aegyptiacus (Radoszkowski)

1888. *Wesmaelinius aegyptiacus* Radoszkowski, *Bull. Soc. Nat. Moscow*, p. 473 (male).

1935. *Homonotus aegyptiacus* Arnold, Psamm. Ethiop. Reg., pt. IV, p. 469, fig 25 (male and female).

Male: 8.5-9 mm. — Black, abdominal segments from III onwards red. Antennae black or reddish at base, clypeus in front, labrum and palpi ferruginous. Fore legs (except the dark coxae and base of femora) ferruginous, rest of legs black, but middle and hind tarsi brownish. *Calcaria of middle and hind tibiae whitish.* Body with fine grey pubescence, tergite I in basal half with silvery pubescence, segment II with narrow silvery basal transverse fascia. Wings yellowish hyaline in basal half, gradually infumated towards apex, without well defined dark apical margin.

Head slightly convex, disk-like, antennae inserted below a callus that is steeply declivous towards the clypeus; the latter flattened, broadly rounded in front, laterally touching the eyes, genae very short. Eyes narrow, inner orbits broadly emarginated for all their length, one eye as broad as one-fourth of frons. Temples, in lateral view, very narrow, one-sixth to one-fifth of the width of the eyes. Joint 3 of the stout antennae well as long as the short scape, apical joints slightly curved. Head somewhat shining, extremely finely and densely punctured, appearing almost aciculated. Prothorax hardly twice as broad as long, sides nearly straight, much narrowed towards apex, hind margin almost straight, but hind angles somewhat protruding posteriorly; prothorax steeply declivous in front. Notauli slightly more strongly incised posteriorly. Scutellum and postscutellum broad, flattened. Postnotum not visible. Propodeum flat, gradually and slightly declivous behind, slightly tapering towards apex, hind angles sharply pointed; surface shining, densely and distinctly punctured, without median sulcus. Abdomen having segment I comparatively broad, all segments are distinctly punctured, tergites I and II with decumbent distinct pilosity (not fine pubescence), segments III and following with ferruginous such pilosity. Ultimate segments strongly shining, little densely punctured, especially so at the posterior margins. Fore wing with basal vein angulated (zigzagged), with a small appendage towards cell m1; pterostigma dark, opaque; cell r3 present, r2 and r3 broad also above, r3 somewhat longer than r2; Cut1 scarcely postfurcal; Cu of fore wing not reaching apical margin. Vein Rt3 of hind wing nearly vertical, far apart from base of R; vein Cut vertical, strongly prefurcal. Middle and hind tibiae exteriorly with silvery-grey pubescence, strongly spinose, longer calcar of hind tibiae two-thirds or more of the length of the metatarsus. Ultimate tarsal joint bare on under side. Claws bifid. Pulvillus slender, half as long as the claws.

Female: According to Arnold the female is 7.5-10 mm. long, having the last three abdominal segments (sometimes also half of the 3rd) ferruginous. The clypeus is longer than in the male, the face narrower. Further differences cf. Arnold (l.c., p. 469).

Habitat: 1 male, Kerdasa, 20.i.1921 (leg. Alfieri).

Homonotus semiflavus spec. nov.

Female: 5.2-5.3 mm. — Head, thorax and propodeum pale ferruginous, abdomen black. Legs (inclusive of coxae) pale ferruginous, spines black, calcaria yellow; antennae from joints 4 or 5 brownish. Wings very slightly shaded, with ill-defined brownish subapical band, occupying the whole cell sc, but narrowing towards hind margin of wing.

Head, in lateral aspect, distinctly convex. Antennal callus steeply declivous in front. Clypeus flat, truncate in front. Head microscopically sculptured. Eyes less than half as broad as one-half of frons; temples, laterally about half as broad as the eye. Genae short. Antennal 3 almots twice as long as 2, somewhat shorter than the oval joint 1, joint 4 as long as 3. Prothorax slightly narrowed towards apex, very finely chagreened. Scutellum and postscutellum flat, the latter wholly, the former posteriorly, somewhat sulcate. Postnotum invisible in the middle. Propodeum with microscopically fine transverse striation and pointed hind angles, and with deep foveola within these productions. Abdominal tergite I broadly impressed, with two indistinct short longitudinal lines at both sides of the basal convexity, at the reflexed sides with a more conspicuous longitudinal line that reaches about the middle of the segment. Sculpture of the abdomen consisting laterally of microscopical transverse striae: pubescence fine, decumbent, grey. Vein Cut1 strongly postfurcal, nearly vertical; two radial cells present, R at base strongly curved, 1st abscissa about as long as 2nd; vein Mt3 interstitial with Rt1. Basalis (M+Mt1) curved in its upper part (M). Cut of hind wing vertical.

Habitat: 1 female, Wadi Abrag, South Eastern Desert, 17.i.1933 (leg. Priesner).

The species seems, as to the formation of the 1st abdominal segment, to be very similar to *H. excavatus* Arn. (from South Africa), but is not identical with it.

VII. Subfamily EPIPOMPILINAE Haupt

Genus MICROPHADNUS Cameron (1905).

1930. *Plagioceps* Haupt, *Mitt. zool. Mus. Berlin*, XVI, p. 777.
1937. *Microphadnus* Arnold, Psamm. Ethiop. Reg., pt. VII, p. 67.

Two radial cells. Basal vein (M) angular below. R of hind wing broken at base, rectangular. Wings slender. Head transverse, eyes large, genae short. Maxillary palpi very slender. Propodeum slender, somewhat constricted and with longitudinal striation, posteriorly. Sternite II of female with shallow transverse furrow. Comb of fore tarsi weak. Claws with very small, blunt tooth.

Microphadnus pumilus (Costa)

1882. *Aporus pumilus* Costa, Fauna Nap. Pomp., p. 54, pl. 8b, fig. 8.
1930. *Plagioceps pumilus* Haupt, *Mitt. zool. Mus. Berlin*, p. 779, figs. 78-80 (further references).

Female: 6-7 mm. — Body, legs and antennae black. Body not very conspicuously covered with pruinose brown pubescence that becomes more greyish at the sides and may form an indistinct transverse fascia at the end of the 1st and 2nd tergite of the abdomen. Wings almost hyaline, with straight and sharply defined apical darkening.

Legs and antennae slender, joint 2 of the latter elongate, 3 as long as 1 and 2 combined. Clypeus broad, touching eyes laterally. Maxillary palpi long and slender, particularly joint 3. Distance of eyes on the vertex smaller than across apex of them. Head somewhat transverse, temples very flat. The eye is as broad as half of frons. Head much broader than the prothorax. Propodeum slender, strongly narrowed posteriorly, with conspicuous, fine, longitudinal striation at the declivity, and between the striae very finely transversely wrinkled. Sternite II with a shallow transverse depression. Wings slender, basal vein angularly broken, about S-shaped; vein Cut1 slightly postfurcal; Cu of fore wing reaching margin as a trace only; Rt1 and Rt2 converging anteriorly. Rt3 of hind wing near base of R, longer than the 1st abscissa of R where the latter is angularly broken; vein Cut is an oblique transverse vein, i.e. it forms an obtuse angle with the analis. The longer calcar of the hind tibiae about half as long as the metatarsus. Ultimate tarsal joint with spines on the under side. Claws with small tooth. Pulvillus slender, with few comb bristles.

Male: According to Haupt the male (4-5 mm.) is more slender, but in colour and structure of wing scarcely differing from the female.

Habitat: I saw a few specimens from Manshiet-el-Radwan, Magadla and Helwan (ix.-xi.).

Distribution: Mediterranean area, Lake Nyassa, Madagascar.

Genus IDOPOMPILUS Kohl

1899. *Eidopompilus* Kohl, *Ann. Nat. Mus. Wien*, XIV, p. 305.
1930. *Idopompilus* Haupt, *Mitt. zool. Mus. Berlin*, XVI, p. 761.
1936. *Idopompilus* Arnold, Psamm. Ethiop. Reg., pt. V, p. 76 (key).

Wings narrow, somewhat surpassing the middle of the abdomen or shorter, with only *two* radial cells. Cell sc small, triangular, only a little longer than the small pterostigma. Cell r2 triangular. Vein Cut1 postfurcal. Cut of hind wing obliquely arising from analis, and ending strongly postfurcal. R of hind wing angularly broken. Prothorax slender, sides widened in front and somewhat reflexed so that they are distinctly visible from above. Fore tarsi without comb. Claws simple. The Egyptian species is black, with dark wings having a hyaline transverse fascia.

Idopompilus arnoldi spec. nov.

Female: 9-9.5 mm. — Body, legs and antennae black. Pubescence on head, thorax and abdomen finely brown pruinose, prothorax at the anterior sides, coxae and propodeum behind with silvery grey pubescence. Wings strongly infumated, with a hyaline transverse fascia across the cells r2, m3 and basal half of cu3. Hind wing nearly hyaline.

Inner orbits almost parallel below, slightly converging towards vertex, emargination of eyes slight. Sulcus of frons visible only right above antennae. The eye somewhat but little narrower than half of frons. Temples, from above, strongly narrowed behind eyes; in lateral aspect broadest somewhat below middle of sides, a little broader than half of the width of the eyes. Frons with a slight impression around base of each antenna. Clypeus about 2.5 times as broad as long, laterally touching the eyes. Genae extremely short. Palpi long. Antennae slender, joint 3 scarcely longer than 1 and 2 combined, little longer than 4. Ocelli forming a right (scarcely pointed) angle, (ool) nearly equalling (pol). The greyish pubescent sides of the prothorax broadest in front where they are broadly reflexed, the upper part of the prothorax practically parallel-sided. Scutellum and postscutellum little convex. Postnotum almost as long as the postscutellum, transversely striate, with fine median sulcus. Propodeum slightly and evenly convex, not impressed posteriorly, with median longitudinal sulcus. Abdomen normal. Wings comparatively narrow, and very moderately long, reaching only a little beyond middle of abdomen. Basal vein straight and strongly oblique, nervulus vertical and *distinctly postfurcal*. Cell sc small, triangular, almost closed above, cell r1 below well 2.5 times as long as cell r2; Rt1 and Rt2 nearly straight, oblique; cell m3 pointed at its proximal basal angle; 2nd recurrent vein (Mt3) only very little prefurcal, almost interstitial. R of hind wing angularly bent, Rt3 strongly oblique, Cut forming an obtuse angle with A, and a pointed one with Cu, at its apex; Mt2, too, forms a pointed angle with Cu. The longer calcar of the hind tibiae is about half as long as the metatarsus. Tibial spines fine, dark. Anterior metatarsus with three extremely short comb spines which are not longer than the apical width of the metatarsus; anterior metatarsus scarcely as long as the three following tarsal joints combined. Claws not dentate. The last tarsal joint bears a few fine spines on the under side.

Male unknown.

Habitat: 1 female, Ghazza, leg. Stenton (1917) (coll. Min. Agric.).

Of the great number of species of the Ethiopian fauna described by

Arnold in his Monograph (1936, pt. V, pp. 73-76) our species seems to come near to *I. kohli* Arn., but differs by the parallel-sided prothorax (sc. its dorsal part), other coloration of the fore wing, and the not fully closed cell r2.

Genus GONAPORUS Ashmead

1902. *Gonaporus* Ashmead, *Canad. Ent.*, XXXIV, p. 88.
1930. *Gonaporus* Haupt, *Mitt. zool. Mus. Berlin,* XVI, p. 770.

Two radial cells present, r2 narrow above. R of hind wing broken at base, Rt3 strongly oblique, as long as or mostly longer than basal abscissa of R; transverse anal vein (Cut) oblique, forming an obtuse angle with analis. Wings with abrupt blackish apical spot. Body densely clothed with pale decumbent hairs. Head broader than the thorax. Postnotum well developed, bare. Fore tarsi of female with comb. Claws bifid. .

Key to Egyptian species

1 (2) 1st and 2nd abscissa of R of fore wing subequal in length. Abdomen and legs (inclusive of coxae) ferruginous. .... **gracilis (Klug)**
2 (1) 1st abscissa of R shorter than 2nd. Coxae and femora for the major part darkened. .... **alfierii spec. nov.**

Gonaporus gracilis (Klug)

1834. *Pompilus gracilis* Klug, Symb. phys., pl. 39, fig 12 (female). ,
1930. *Gonaporus gracilis* Haupt, *Mitt. zool. Mus. Berlin,* XVI, p. 772, figs. 72-75.

Female: 6.5-10 mm. — The whole body inclusive of legs and antennae pale ferruginous, upper part of frons and vertex blackened. Head and thorax with dense and fine, whitish decumbent pubescence. Abdomen, antennal 1 and legs with whitish pubescence. Wings hyaline, with black apical spot that only reaches the apex of cell sc.

Ocelli forming a right angle, (pol) somewhat longer than (ool). Frons without sulcus. Temples flattened. Inner orbits nearly parallel below, strongly convergent in upper two-fifths. Clypeus flatly rounded in front. Genae short. Antennae very slender, joint 3 nearly twice as long as 1, joints 4 or 5 longer than 1 and 2 united. Pronotum posteriorly obtusely angled. Postnotum finely transversely striate, without median impression, slightly pubescent at least laterally, somewhat shorter than the postscutellum. Abdomen slender, tergite I narrowed towards base, sides straight, the segment almost petiolate. Legs slender, fore tarsi with fine comb of subequally long pale spines, those on the metatarsus about as long as tarsal joint 3. Veins Rt strongly oblique, straight or Rt1 slightly wavy; 1st and 2nd abscissa of R subequal in length; Cu not reaching apical margin. R of hind wing broken at base, forming a right or obtuse angle, Rt3 somewhat longer than basal portion of R. Cut of hind wing slightly S-shaped, prefurcal.

Male: According to Haupt the male is much darker, body and antennae being black, only segments I-III of the abdomen ferruginous, tergite VII whitish. Legs black, knees, apex of tibiae, calcaria and most of the metatarsus (tip blackened) white, tarsi black. Rt1 curved. Basal vein in both parts slightly curved, nervulus somewhat prefurcal. Frons with sulcus, (pol) = (ool). Cheeks longer. Claws apparently simple. As to my opinion this male does not belong to *Gonaporus* (Patria: Algeria).

Habitat: Beni Youssef, Suez Road, Fayoum (leg. Mochi and Alfieri); Meadi, Mokattam; Romani (coll. Min. Agric.)

Gonaporus alfierii spec. nov.

(Fig. 7)

Female: 6.5-9 mm. — Ground of anterior body black, pubescence dense and yellowish-grey; on the head below the antennae and on its under side, on antennal 1 below, the pubescence is white. Abdomen ferruginous, segments IV and V at base black, all segments with dense decumbent yellowish grey pubescence. Legs ferruginous, with pale spines, but blackened tips of tarsi, base of hind femora and mostly the wholly dark fore and middle femora, with red articulations and red tips of tibiae. Legs with dense white pubescence. Antennae black, mandibles yellow, tips dark. Wings hyaline, with milky opacity, and sharply defined dark apical spot the interior margin of which is obtusely angled and touches cells sc at fore margin of wing. Head with a row of raised bristles along interior orbits. Temples with raised white hairs that are denser and longer than in *gracilis*. Pubescence of propodeum and sides of body more whitish than yellow.

Antennal joint 3 longer than 1 and 2 combined. The eye about one-fourth of width of frons. Ocelli forming a right or slightly pointed angle. Temples, in lateral aspect, somewhat more than one-third as thick as the eyes. Head much broader than prothorax, but not twice as broad. Prothorax almost parallel-sided, in the middle half as long as broad. Scutellum slightly convex. Postnotum about half as long as the postscutellum, *black, bare*. Propodeum slightly narrowed towards apex. Wing venation similar to that of *gracilis,* but the 1st abscissa of R of fore wing distinctly shorter than the 2nd; cell r2 above only one-third as long as below, much higher than long. Cu of fore wing reaching the apical margin of the wing. Cut of hind wing prefurcal for its whole length; Rt3 more than twice as long as the basal part of R. Metatarsus of for legs with three long pale comb spines of which the apical one is well as long or slightly longer than the 2nd tarsal joint, i.e. longer than in *gracilis;* a moderately long comb spine is present on the under side of the metatarsus. Last joint of hind tarsi with fine spines on the under side. Calcaria of tibiae whitish with black tip. Claws bifid, inner branch truncate.

Habitat: Not rare. Ikingi (Mariout), Amriah, Abukeer; Abu Rowash, Mansuria, Kafr Hakeem; Pyramids of Giza, Bedreshein, Fayoum; Gebel Asfar, Wadi Umm-Assaad, Wadi El-Tih, Wadi Digla, Helouan; Fayed. Gebel Elba (Wadi Aideb). The whole year round. (Coll. Min. Agric., Soc. Ent., Mochi, Alfieri. Priesner).

Genus XENAPORUS Ashmead

1902. *Xenaporus* Ashmead, *Canad. Ent.*, XXXIV.
1930. *Xenaporus* Haupt, *Mitt. zool. Mus. Berlin*, XVI, p. 770.
1930. *Taeniaporus* Haupt, l.c., p. 774.

Close to *Gonaporus,* with all characters of this genus except that the claws are simple, neither visibly dentate nor bifid. Cell r2 is very narrow above or even pedicellate.

Typ. gen. *X. amoenus* (Klug).

Key to Egyptian species

Females

1 (4) Cu of fore wing attaining apical margin. Apical dark spot of fore wing distant from cell sc.

2 (3) The whole body and the wing veins (except within the black apical spot) pale ferruginous. All legs pale. Antennae pale ferruginous at base. .... **cheopis spec. nov.**

3 (2) Body black beneath pubescence, only the base of the abdomen (segments 1-2 (-3)) ferruginous. .... **tenellus spec. nov.**

4 (1) Cu of fore wing not reaching apical margin. The apical dark spot reaching cell sc or coming very close to it.

5 (8) Postnotum dark brown or black. Coxae partly and base of femora blackened.

6 (7) Cell r2 closed above or pedicellate. Abdomen more or less darkened at apex, segments with apical ill-defined bands of grey pubescence. .... **amoenus (Klug)** (23)

7 (6) Cell r2 not closed, but above one-fourth to one-third as broad as below. Abdomen wholly ferruginous, evenly pubescent. .... **devius spec. nov.**

8 (5) Postnotum ferruginous. Legs, inclusive of coxae, ferruginous. Cell r2 pedicellate. .... **rishedensis spec. nov.**

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(23) *Taeniaporus orichalceus* Saund., Haupt (*Mitt. zool. Mus. Berlin,* XVI, p. 774, figs. 76, 77) must come close to this species; it is in any case congeneric.

Males

1 (2) All abdominal segments with greyish pubescence. **tenellus spec. nov.**
2 (1) Segments IV and V with blackish pubescence. ...... **amoenus (Klug)**

Xenaporus amoenus (Klug)

1812. Unnamed, Savigny, Descr. d'Egypte, pl. 18, fig. 19.
1834. *Pompilus amoenus* Klug, Symb. phys. pl. 39, fig. 13 (female).

Female: 4.5-8 mm. — Fore margin of clypeus, mandibles (tip dark), antennal joint 1 below, prothorax, apices of coxae, femora (except the dark base and mostly fore margin), tibiae and metatarsi, *ferruginous;* propodeum varying in colour, wholly ferruginous or dark at base, and sometimes only the apex pale; abdomen ferruginous to brownish, thus segments IV to VI dark, sometimes II and III brownish at base, its pubescence is whitish-grey, particularly at the posterior margins of the segments II-IV; base of segment IV dark pubescent, on segment VI the pubescence is wholly dark. The whitish pubescence is always more conspicuous at the margins than at the base of the segments. Wings with sharply defined apical spot that reaches the tip of cell sc.

Antennae slender, joint 3 as long as 1 and 2 combined, 4 subequal to 1. Genae short, but mandibles and clypeus not quite touching the eyes. The eye about half as wide as the frons, the latter below very little broader than above. Head with grey pubescence that becomes slightly yellowish on the vertex. Ocelli forming a right angle, (pol) subequal (ool). Temples about half as thick as the eyes. Pronotum not twice as broad as long, hind margin obtusely angled. *Postnotum black, bare,* in the middle somewhat broader than at the sides, but much shorter than the postscutellum, about half as long as it. Propodeum with deep median sulcus. Vein Cut1 interstitial or very slightly postfurcal; Cu of fore wing does not reach the apical margin; cell r2 triangular, *closed above* (seldom shortly petiolate); Rt1 oblique, straight, Rt2 slightly curved; Mt2 and Mt3 forming mostly subequal abscissae on M. Vein Rt3 of hind wing strongly oblique, twice (or more) as long as the basal abscissa of R which is broken with a pointed angle; Cut strongly prefurcal. Anterior metatarsus with three moderately long dark comb spines; ultimate comb spine as long as tarsal joint 2 or slightly shorter; inferior comb spines wanting; ultimate tarsal joint without spines on the under side. Claws simple, pulvillus distinct but slender, scarcely bilobed, plate with few comb bristles two of which are conspicuous.

Male: 3.6-6.4 mm. — Black, with grey-white decumbent pubescence; antennal joint 1 and 2 reddish below, fore margin of clypeus and the mandibles, lateral and posterior margin of the prothorax, abdominal segments

I-III, tip of fore femora, the middle and hind femora (except base and fore margin), the tibiae (anterior tibiae slightly shaded), the base of the metatarsi and the hind margin of the propodeum, ferruginous. Pubescence of abdominal segments I-IV grey, of V and VI blackish brown, of VI grey at the middle of the apical margin, the latter being ferruginous on the ground; segment VII pinkish; sternites V-VII black, with blackish pubescence.

Antennal 1 twice as long as broad, 3 and 4 subequal to 1, 3 twice as long as 2, and 2.5 times as long as thick. Postnotum much broader at middle than at the sides, but somewhat shorter than the postscutellum, Cut1 slightly postfurcal. Cell r2 closed, or to one-fifth as broad above as below. Calcaria of hind tibiae black, the longer one about half as long as the metatarsus.

Habitat: I found this species represented in all collections examined, and collected it myself in numbers in the Wadi Digla and Wadi Hof. Other localities: Borgash, Kerdasa, Abu Rowash, Gebel Asfar, Wadi Umm-Assaad, Wadi Rished; Ikingi (Mariout); El-Areesh (Sinai); (iv.-x.).

Xenaporus orichalceus (Saund.)

1901. *Pompilus (Evagetes) orichalceus* Saunders, *Trans. Ent. Soc. London,* p. 546, (female).
1930. *Taeniaporus orichalceus* Haupt, *Mitt. zool. Mus. Berlin,* XVI, p. 775, figs. 76, 77.

On describing the genus *Taeniaporus* Haupt stated that he did not know the type species of *Xenaporus* Ashm. (sc. *X. amoenus* Klug), but that he believed that *X. amoenus* comes close to *T. orichalceus* (Saund.). From the wing venation it appears that *T. orichalceus* Haupt must belong to *Xenaporus.* The statement that the 2nd joint of the fore tarsi bears only 1 comb spine seems not to agree with the fig. 77 (p. 775) which distinctly shows a median and an apical spine. The examples of Saunders seem not to be identical with *amoenus* Klug since Saunders remarks: « Pleurae and head posteriorly also with fine rather long erect pale hairs ». Neither *X. amoenus,* nor *X. cheopis,* nor *X. rishedensis* possess raised hairs on the temples. Such a pilosity has only the male of *tenellus* which differs from Saunders' species in the colour of the pubescence and that of the body and legs.

Xenaporus devius spec. nov.

(Fig. 30)

Female: 6.5 mm. — Fore margin of clypeus, mandibles (except the dark tip), antennal joint 1 below, prothorax, apex of the black coxae, the legs (except base of femora and the tarsi from joint 2 onwards), the posterior half of the propodeum, and the *whole abdomen,* ferruginous; the other parts of the body dark. Body densely and finely clothed with greyish-white pubescence that is *even* on all abdominal segments, without showing a darkening on the apical segments. Wings with sharply defined dark apical spot that reaches only the cell sc.

The structural characters are the same as in *X. amoenus,* the comb spines of the anterior metatarsus dark and distinctly shorter than the 2nd tarsal joint. However, cell r2 is *not* closed above, but one-fourth to one-third as broad as below, and the two veins Rt are straight ; vein Mt3 shows a greater distance from Rt2 than in *X. amoenus* in which the three abscissae of cell r2 (below) are subequal in length, while in *X. devius* the third abscissa is only half as long as the 2nd, the 1st somewhat shorter than the 2nd. Claws simple.

Habitat: 1 female, Wadi Umm-Assaad, 14.x.1936 (leg. and coll. Alfieri).

Xenaporus tenellus spec. nov.

Male: 5-6.5 mm. — Ground of body and antennae black, only joint 1 sometimes ferruginous beneath, mandibles yellowish ; abdominal segments I-II (-III) more or less ferruginous, the dark posterior segments narrowly pale at the posterior margin, tergite VI whitish at apex, VII wholly so. Coxae and femora dark, the latter ferruginous at apex, tibiae ferruginous, tarsi blackened. The whole body, the legs and the two first antennal joints with dense grey pubescence, the *postnotum bare, black.* Wings hyaline, somewhat milky-white, dark apical spot sharply defined, reaching vein Cu posteriorly ; hind wing hyaline. The veins pale brownish, darkened at apex of wing, vein Sc+R+M wholly dark.

The eye almost as broad as half of the frons, emarginated interiorly ; frontal sulcus conspicuous. Temples and vertex above with some erect whitish hairs. Antennal joint 3 more than twice as long as 2, joint 4 as long as or scarcely longer than 3, longer than 1. Ocelli forming a right angle, (pol) subequal to (ool). Prothorax forming at hind margin a low obtuse angle. Scutellum, in lateral aspect, convex ; postnotum more than half as long to as long as the postscutellum, bare, black. Propodeum in front with conspicuous fine median sulcus. Genital plate black, in lateral aspect very slightly convex, in apical third with a few obliquely erect bristles, shape triangular, with median carina. Wings with basal vein straight and nervulus (Cut1) interstitial, vertical ; cell r2 as a whole triangular, above (=2nd abscissa of R) as long as or a little longer than 1st abscissa, below almost three times as long as above ; veins Rt straight ; the two recurrent veins (Mt2 and Mt3) end at the 1st half of the lower margin of cell r2, Mt2 therefore about in the middle and far distant from Rt2. R of hind wing rectangularly broken, with very short basal part, Rt3 oblique; Cut forming an obtuse angle with Cu and being strongly prefurcal. Terminal tarsal joint with a pair of extremely minute spines on the under side so that the hitherto unknown female of this species is expected to have quite conspicuous inferior spines. Claws not dentate.

Habitat: Several specimens from the Wadi El-Tih and Meadi (iii.-v., leg. Priesner); Beni Youssef, 15.iv.1934, leg. Mochi; Abu Rowash, 15.i.1927 (coll. Min. Agric.).

Xenaporus cheopis spec. nov.

Female: 6-6.5 mm.—*The whole body pale ferruginous,* only the antennae about from joint 4 or 5 and the tarsi from joint 2 or 3 onwards, blackened. Head not or only slightly shaded. Apical dark spot of fore wing sharply defined, rather far apart from cell sc, accompanying the apex of Cu behind but not attaining it. Veins of wing yellowish, Sc+R+M little darker, Co behind cell sc blackened, tip of M and Cu dark. The whole body is clothed with yellowish decumbent pubescence.

The eye as broad as half of frons, orbits not emarginated, very slightly converging towards vertex. *Genae long.* Clypeus almost evenly rounded in front, distant from eyes laterally. Temples, in lateral aspect, widened towards apex. Sulcus of frons conspicuous. Ocelli far apart from one another, forming an acute angle, (pol) much longer than (ool). Joint 3 of the slender antennae about as long as 1 and 2 combined, 4 much shorter, about as long as 1. Prothorax scarcely convex, sides nearly parallel, hind margin forming an obtuse angle. Scutellum distinctly, postscutellum little convex, postnotum somewhat shorter than the postscutellum, bare in the middle, with feeble median sulcus. Propodeum scarcely sulcate, at the base. Basal vein slightly curved, nervulus interstitial ; cell sc narrow ; cell r2 triangular, above about one-fourth as long as below ; veins Rt nearly straight, Rt2 vertical, Rt1 strongly oblique ; the two recurrent veins (Mt) forming subequal abscissae at the base of cell r2, or the median abscissa is slightly longer ; Mt3 ends strongly prefurcal. R of hind wing broken, *forming an acute angle,* Rt3 very much oblique, and long ; Cut straight, forming an obtuse angle with An, much prefurcal. Metatarsus of fore leg with three very long whitish comb spines which are distinctly lanceolate, and the last of which reaches about the apex of the 3rd tarsal joint ; there are two long fine inferior comb spines present. Terminal tarsal joint without spines on the under side. Pulvillus large, broad, blackish, comb bristles conspicuous. Claws not dentate.

Habitat: 2 females, Pyramids of Giza, 15.vi.1934, leg. Priesner.

Xenpaorus rishedensis spec. nov.

Female: 5.5 mm. — Pale ferruginous ; head (excepting the ferruginous orbits, the lateral and apical margin of the clypeus, the mandibles and palpi), scutum and mesopleurae, blackened. Legs wholly pale ferruginous, tarsi darkened, calcaria paler. Apical spot of the hyaline wing sharply defined, *not reaching the cells,* except the tip of cell sc. Antennae with joints 1-3 (-4) pale ferruginous, apex brown to blackish. Body with fine silvery pruinose pubescence, on the propodeum and the abdomen it is more yellowish grey.

Eyes having orbits slightly converging towards vertex, very little emarginated, one eye distinctly narrower than half of frons. Genae short. Temples (laterally) thick but not quite as broad as the eyes. Ocelli forming an acute angle, (pol) somewhat shorter than (ool). Clypeus not quite attaining the eyes, straight in front. Antennae slender, joint 3 shorter than 1 and 2 combined, 2 being comparatively elongate, 1 or 4 little shorter than 3. Prothorax little convex, about parallel-sided, angularly excavated at hind margin. Scutellum and postscutellum rather flattened, postnotum pale, *bare,* somewhat more than half as long as the postscutellum, with median sulcus that continues into an almost complete sulcus of the propodeum. Wings narrow, basalis straight, nervulus interstitial ; *cell r2 triangular and pedicellate ;* veins Rt straight, the two recurrent veins dividing the lower margin of cell r2 into three subequal parts ; Cu of fore wing ending far from margin. R of hind wing almost rectangularly broken at the extreme base, Rt3 very much oblique ; Cut oblique, forming with An an obtuse angle and ending upon Cu much prefurcal. Fore tarsi with moderately long comb spines (much shorter than in *X. cheopis*), comb composed of three spines on the metatarsus, the last spine surpassing the middle of the 2nd tarsal joint ; two inferior comb spines present, but very short ; ultimate tarsal joint without spines on the under side. Pulvillus slender, claws rather long, not dentate.

Habitat: 1 female, Wadi Rished (viii.), leg. Priesner.

Genus MICRAPORUS nov.

Wings moderately long, with only one recurrent vein, Mt3 wanting (Fig. 31). Two radial cells present ; veins Rt straight, 2nd abscissa of R subequal to 1st. R of hind wing obtusely angled near base, Rt3 about three times as long as the basal part of R. Wings with black apical spot. Head across temples, in dorsal aspect, narrower than across eyes, parallel-sided only for a very short distance behind eyes. Antennae and legs moderately slender. Pubescence of body fine, pruinose. Tibiae almost spineless, fore tarsi without comb. Tarsi comparatively short and stout, spines at apex of joints minute. Claws small, simple. Very small species.

Typ. gen. *Micraporus hofensis* spec. nov.

I do not know definitely in which subfamily this genus should be placed. According to the chaetotaxy of the femora and tibiae it would come into Haupt's Pompilidae lissoscelidae. However, according to the venation the new genus has to join the *Epipompilinae*. Moreover, Arnold states (l.c., part IV, p. 416) that also in some species of *Idopompilus* « not the slightest trace of spines can be found on any part of the hind femora, even under very high magnification ». For this reason I believe that I have correctly placed this new genus.

Micraporus hofensis spec. nov.

(Fig. 31)

Female : 4-4.3 mm. — The whole thorax pale ferruginous, head blackish, the mesopoleurae and the propodeum in one specimen with very slight darkening ; clypeus, antennal joint 1, abdomen and legs (inclusive of coxae) pale ferruginous ; tarsi and calcaria blackish ; on the abdomen the segments (I-) II-IV show ill-defined dark fasciae. Wings hyaline with brown veins and dark apical spot that begins far from the cells but touches cell sc at tip ; hind wings hyaline. The body is clothed with a fine, pruinose, grey pubescence which is somewhat denser on the frons, the anterior part of the prothorax, the sides of the body, and the coxae, though the pubescence does not wholly cover the ground.

Frons about three times as broad as the eye ; sulcus only above the antennae slightly indicated. Temples, in lateral aspect, thick, broadest in the middle, more than half as broad as the eye. Ocellar triangle about rectangular, (pol)=(ool). Clypeus short, strongly transverse, truncate in front, not quite touching the eyes laterally. Genae short, palpi long. Antennal joint 3 scarcely longer than 1 and 2 combined, joint 4 as long as 1. Antennae comparatively stout. Prothorax only slightly convex, sides very slightly rounded, as a whole about parallel-sided, hind margin excavated, obtusely angled. Scutellum rather flat, postnotum conspicuous, somewhat shorter than the postscutellum, ferruginous (not black), posterior limitation forming an even arc. Postnotum nearly bare in the middle, emarginated, distinctly whitish pubescent at the sides. Propodeum little convex, without median sulcus. The abdominal tergites II and III very slightly excavated at middle. Wings comparatively shorter than in *Xenaporus*. Basalis curved below (Mt1). Cut1 interstitial, somewhat oblique ; cell r2 about triangular, above somewhat more than one-third as long as below ; between M and Cu there is only one recurrent vein (Mt2) that ends about at the first third of cell r2, i.e. in front of its middle ; cell m3 (which is open) only little pointed at the proximal basal angle ; Cu of fore wing rather long, but not fully reaching the apical margin. R of hind wing broken but in an obtuse angle ; Cut forming an obtuse angle with m $1+2$, very strongly prefurcal. Middle tibiae with only a few spines, exteriorly, hind tibiae bare, without spines, apical spines extremely short, straight. Fore tarsi short, stout, metatarsus without comb spines, the organ for preening occupies half of the length of the metatarsus. Calcaria of hind legs stout, the longer one half as long as the metatarsus; ultimate joint of tarsi without under side spines. Pulvillus small, short, dark. Claws not dentate.

Male: 3 mm. — The venation is the same as in the female, only the nervulus is slightly postfurcal, and the darkening of the fore wing is paler and does not reach Cu. Body black, abdomen somewhat reddened at base, antennal joints 1 and 2 ferruginous beneath, clypeus at fore margin and mandibles reddish. Femora and tibiae ferruginous with marginal darkenings.

Antennae short, joint 3 almost twice as long as 2, little longer than 4. Postnotum as in the female an evenly wide narrow band, but black, bare. Prothorax narrowed towards apex. The whole body covered with a dense grey pubescence, but on the abdomen only the segments I-III so, segments IV-VI with blackish pubescence ; tergite VI with yellowish hind margin, VII whitish yellow. Genital plate triangular and pointed, in lateral aspect almost flat, without longer bristles.

Habitat: 2 females, Wadi Hof, 12.vi.1930 ; 1 male, Wadi El-Tih, 14.vi.1935 ; leg. H. Priesner.

The insect is at first sight habitually similar to *Xenaporus*, and is certainly, like the species of this genus a form adapted to desertic biotopes.

ADDENDUM

Pompilus hirticollis Costa (*Atti acad. sci. fis. Napoli,* VII, ? 1878, p. 21 (both sexes)) is not included in this paper. the author having not succeeded to obtain the original description.

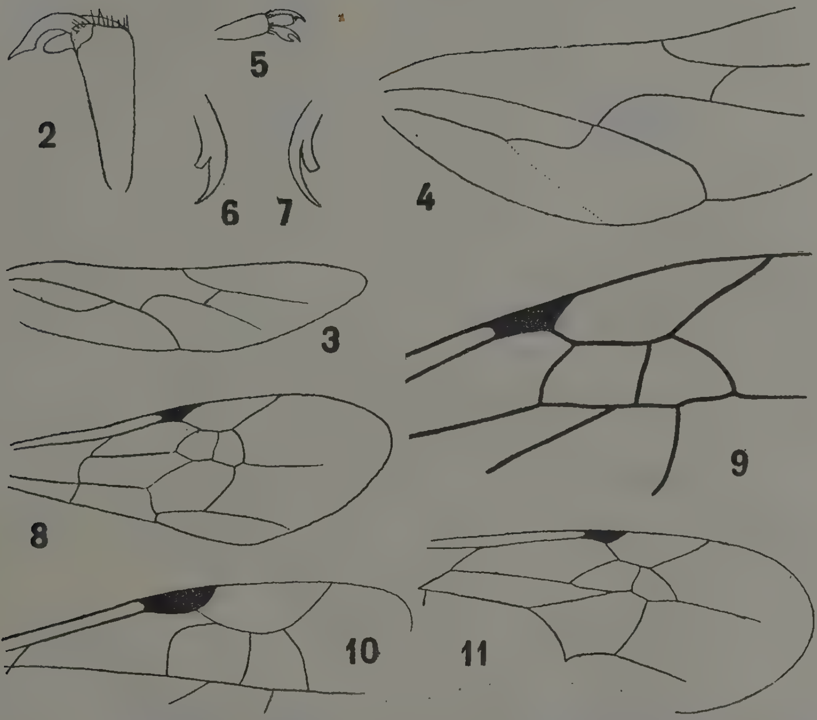
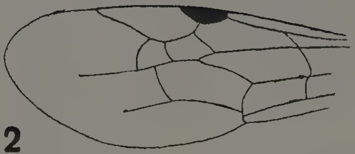


Fig. 2: *Ctenagenia vespiformis* (Kl.): Apical joint of fore tarsus of male, showing interior claw (x 32.5). — Fig. 3: *Aporus hirtipennis* Saund.: Hind wing of female, showing apical part of Cu evenly and slightly curved (x 15). — Fig. 4: *Pompilus calidus* (Guér.): Hind wing of male, showing apical part of Cu abruptly bent in distal third (x 15). — Fig. 5: *Pompilus waltli* Spin.: Last joint of fore tarsus of male, showing difference between exterior and interior claw (x 32.5). — Fig. 6: *Episyron anticus* (Kl.): Bifid claw (female) (x 32.5). — Fig. 7: *Gonaporus alfierii* sp. n.: Bifid claw (hind leg of female) (x 32.5). — Fig. 8: *Pompilus (Ageniopompilus) spiniprivus* sp. n.: Fore wing of female (x 15). — Fig. 9: *Pompilus (Arachnospila) mimus* sp. n.: Part of fore wing of female (x 15). — Fig. 10: *Pompilus (Arachnospila) mareoticus* sp. n.: Part of fore wing of female (x 15). — Fig. 11: *Pompilus (Arachnospila) litorellus* sp. n.: Fore wing of female (x 15).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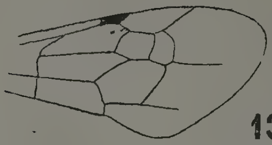
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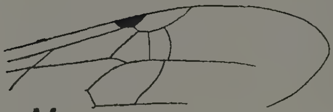
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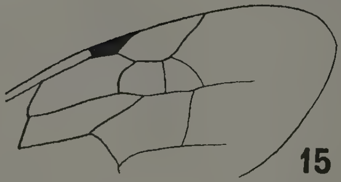
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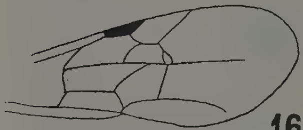
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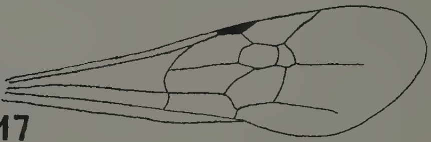
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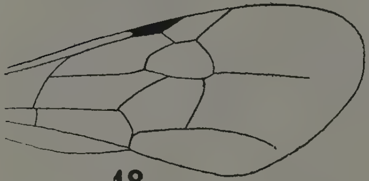
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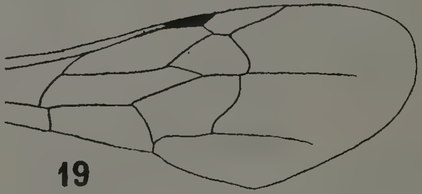
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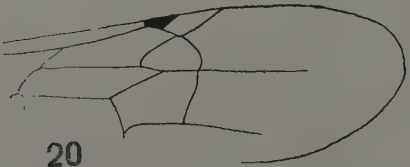
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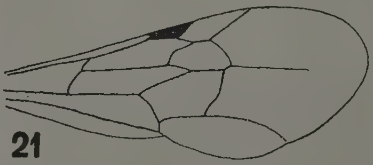
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Fig. 12: *Pompilus* (*Nanoclavelia*) *aegyptorum* sp. n.: Fore wing of male (x 15). Fig. 13: (?) *Pompilus sayedi* sp. n.: Fore wing of male (x 15). — Fig. 14: *Pompilus arcanus* sp. n.: Fore wing of female (partly) (x 15). Fig. 15: *Pompilus astutus* sp. n.: Part of fore wing of female (x 15). — Fig. 16: *Leuchimon petiolatus* sp. n.: Fore wing of female (x 15). — Fig. 17: *Leuchimon mochii* sp. n.: Fore wing of female (x 15). — Fig. 18: *Evagetes* (*Tachyagetes*) *pharaonum* (Kohl): Fore wing of female (x 15). — Fig. 19: *Evagetes* (*Tachyagetes*) *arabicus* sp. n.: Fore wing of female (x 15). — Fig. 20: *Evagetes* (*Tachyagetes*) *rarus* sp. n.: Part of fore wing of female (x 15). — Fig. 21: *Evagetes* (*Tachyagetes*) *alter* sp. n.: Fore wing of female (x 15).

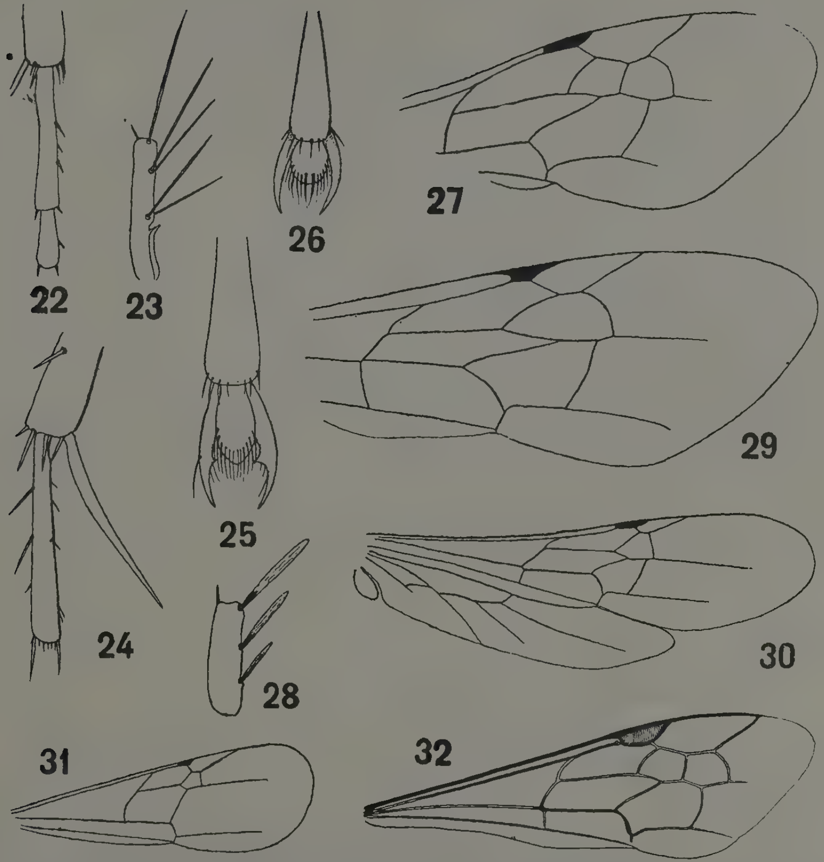

Fig. 22: *Evagetes* (*Tachyagetes*) *alter* sp. n.: 1st and 2nd joint of fore tarsus of female; the median spine on the metatarsus is an inferior one, the others (2+1 apical) are the lateral spines (x 32.5). — Fig. 23: *Evagetes* (*Epagetes*) *genalis* sp. n.: Anterior metatarsus of female (x 32.5). — Fig. 24: *Evagetes* (*Epagetes*) *genalis* sp. n.: Middle tibia+metatarsus (with calcar), of female (x 32.5). — Fig. 25: *Dicyrtomellus claviger* (Taschbg.): Apex of hind leg, showing dentate claws (female) (x 32.5). — Fig. 26: *Dicyrtomellus dentiprivus* sp. n.: Apex of hind leg, showing simple claws (female) (x 32.5). — Fig. 27: *Schistonyx minor* sp. n.: Fore wing of female (x 15). — Fig. 28: *Chionopompilus rabinovitchi* gen. et sp. n.: Anterior metatarsus of male (x 32.5). — Fig. 29: *Telostegus sabulicola* sp. n.: Fore wing of female (x 15). — Fig. 30: *Xenaporus devius* sp. n.: Wings of female (x 15). — Fig. 31: *Micraporus hofensis* gen. et spec. nov.: Fore wing of female (x 20). — Fig. 32: *Pompilus* (*Nanoclavelia*) *lacteipennis* Haupt: Fore wing of male (del. Haupt).

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Some biological aspects of the *Eulecanium corni* Bouché-group

[Hemiptera : Coccidea]

(with 5 Text-Figures and 4 Tables)

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This is a part of the work carried in Silwood Park Field Station (Imperial College), Berkshire, England, on the bionomics of *Eulecanium corni.* It deals with five different aspects of the general biology of this insect. These are : (1) synonymy, (2) host plants, (3) life-cycle and generations, (4) effect of temperature on the incubation period and mortality of eggs, and (5) population density in relation to the nature of the host plant.

I. SYNONYMY

Eulecanium corni Bouché is a polyphagous scale insect, which presents a wide range of forms when occurring on different host plants. These forms differ markedly in size, shape and colour, etc.. This caused a great deal of confusion in its identification which resulted in a large number of synonyms being given by the different authors. Some of the forms were either considered as different species altogether or as varieties of the species *corni.* The writer reviewed the lists of synonyms published by the different authors, i.e. Newstead (1902), Marchal (1908), Green (1930), Lindinger (1934), and Savesco (1944). The morphology, biometry and influence of host plant were studied on several forms of this insect occurring on different host plants. This study showed that all those forms were one and the same species including the form occurring on *Robinia pseudoacacia* which was considered by Marchal (1908) as the variety *robiniarum.* The only form which proved to be a different species was that occurring on *Taxus baccata* and which was considered by Green as the variety *crudum.*

It was obvious from the length of the list of review that the synonymy of this insect has reached a state of confusion. A simplification is necessary and the writer proposes the use of the name _Eulecanium corni_ Bouché for all the different forms (except the variety _crudum_) so long as the host plants are recorded.

Savescu was right in using the same nomenclature, but in naming his ecological forms, his use of both the names of host plants (i.e. f. _ribis,_ f. _mori,_ f. _pyri,_ etc.) and names derived from the previous synonymy (i.e. f. _rugosum,_ f. _assimile,_ etc.) confuses the issue again.

As for the variety crudum from _Taxus,_ the writer is of opinion it should be considered as a distinct species, to which he proposes the name _E. taxi_ n. sp.

II. HOST PLANTS

The available names of the host plants recorded by different authors from various parts of the world were reviewed, and are given below. Host plants recorded by the writer in England are followed by an asterisk.

_Alnus rhombifolia; Amygdalus persicae_*, _A. communis; Betula alba_*; _Bigonia radicans, B. semperflorens; Calluna vulgaris_*; _Cerasus mahaleb; Clematis sp.; Cornus sanguinea_*; _Coryllus avellana; Cotoneaster horizontalis_*, _C. lactea_*, _C. microphylla_*; _Crataegus azarolus_ (aubépine), _C. monogyna, C. oxyacantha_*, _C. pyracantha; Cydonia oblonga; Cyperus papyrus; Cytisus scoparius_*; _Diospyros kaki; Epiphyllum_ sp.; _Fagus sylvatica_*; _Ficus carica, F. elastica; Hedera helix; Juglans regia; Juniperus_ sp. (red cedar); _Lonicera caprifolium_*; _Morus nigra, M. alba; Nerium oleander; Opuntia vulgaris; Platanus_ sp.; _Pelargonium roseum, P. zonale; Philadelphus_ sp.; _Photinia arbutifolia; Pirus communis, P. cydonia, P. malus; Prunus armeniaca, P. avium var. cerasus_*, _P. domestica_*, _P. insititia, P. spinosa; Pyrcantha coccinea_*; _Quercus pedunculata; Rhamnus frangula; Ribes aureum, R. grossularia_*, _R. nigrum_*, _R. rubrum, R. sanguineum_*; _Robinia pseudoacacia_*; _Rosa_ spp.*; _Rubus fruticosus_*; _Spiraea_ sp.; _Syringa vulgaris; Tilia platyphylosa; Ulmus montana; Vaccinium_ sp.*; _Viburnum lantana; Vitis vinifera_*; _Wistaria sinensis._

Green recorded _Eulecanium corni crudum_ on both _Taxus baccata_ and _Aralia_ sp. The specimens obtained by the writer on _Taxus_ are by no means similar to those on _Aralia._

III. LIFE CYCLE AND GENERATIONS

The life-cycle of _Eulecanium corni_ in general is similar in all its different forms occurring on different host plants.

The females start oviposition during the first half of May. They lay their eggs under the concave ventral surface of the body which serves as a plate for covering and protecting them. The eggs are white in colour when newly oviposited but turn to yellow before hatching. The dead eggs are brownish remaining under the body of the adult. The eggs are usually mixed with a white powdery wax secretion. The number of eggs laid by the female varies from one plant to another. In each form there is a correlation between the numebr of eggs and the size of the insect, but taking the whole group of forms as a unit, both the fecundity and the body size are independently affected by the host plant.

Hatching starts late in May under glass or late in June in the field, the incubation period being different in each case (see below). The margin of the body of the female adheres tightly to the host plant except at the anal extremity. The hatching nymphs could be seen crawling out from below the anal cleft, usually with the egg shells still clinging to their hinder parts. They lose the egg shells during their migration, dispersing them on the twig near to their mother or even on the dorsum of the mother herself. The young first stage nymphs are comparatively active and always move towards the extremities of the branches where they settle at first on the tips of the twigs or on either side of the leaves. This continues for a week or two after which they gradually start migrating again and settle hanging upside down mainly on the lower surface of the leaves and the under side of the twigs.

Moulting to the second stage occurs about the middle of July under glass, or in August in the field. This is the hibernating stage during which the nymphs remain nearly fixed until the next spring, and their growth could hardly be observed by the naked eye. However, some individuals could be seen migrating in autumn and in the warm days of winter. In case of deciduous plants the majority of nymphs fixed upon the leaves usually fall away and perish. In general the mortality is very high as will be discussed below. The few remaining nymphs could be seen either on the under side of the horizontal branches, or on the lower parts of the vertical branches and always on the shaded side.

Moulting to the adult stage takes place in March or early in April under glass and late in April in the field. The young adults grow very quickly in the following few days attaining nearly twenty times their original size. They quickly attain maturity and start oviposition in May.

Reproduction is parthenogenetic in nearly all the forms studied. However, males were observed in *Cotoneaster microphylla* in the Royal Horticulture Society Gardens at Wisley. Samples of infested twigs were repeatedly examined at the times when the puparia of the males were formed and the percentage of the males to the total population was found to be low. It was estimated as 4 % ranging from 3-5 %. The sexes are not distinguishable in the first and second nymphal stages, although the male second stages are comparatively longer and narrower than those of the females. About the begining of April the male second stages secrete a thin glassy test of wax, the puparium, under which they moult to the pre-pupa, pupa and adult. The emergence of the males takes place about the end of April or early in May and is indicated about a day beforehand, by the protrusion of the waxy caudal filaments from the anal extremity of the puparium. The emergence of the adult usually takes place at midday, the insect lifting the puparium from its anal end and creeping out backwards. After a short period the male stretches its wings and flies. It has been observed both in the field and in the laboratory that the male mates with a single female only. The male mounts the dorsum of the female in the same direction, inserts its aedeagus in the genital opening through the anal cleft and raises the caudal filaments vertically upwards. The antennae vibrate rapidly. This action lasts nearly 40 seconds and is repeated from four to five times alternating with a resting period lasting from 3 to 4 minutes. After copulation the male usually dies on the dorsum of the female. In very few cases the males moved after mating for about 3 cms., and died on the branch of the plant.

The males were easily reared in the laboratory by simply leaving the slivers of the bark with the puparia on them in specimen tubes covered with muslin. The technique adopted for mating of the transferred insects was as follows.

(1) In case of big trees, e.g. peach, the specimen tube with the newly emerging male was put very near to one of the mature females. On removing the muslin cover, the male usually flew towards the female.

(2) In case of small potted plants, e.g. blackberries, the pot was put under a celluloid cylinder, with a hole in its side wall. The specimen tube was opened and inserted in this hole, and the male could be watched from outside the cylinder.

It has been proved that the males could develop on host plants other than *Cotoneaster microphylla*. Bi-sexual reproduction or in other words fertilised eggs give rise to both males and females, but the percentage of males is always very low. This agrees with the works of Thomson (1927) on *Lecanium hesperidum* and *L. hemisphericum*.

With regard to generations, it was observed that all the forms of *Eulecanium corni* including that on *Robinia* (which had been reported to have two generations a year in France [Marchal 1908] and certain parts of Roumania [Savescu 1944]) have but one generation a year whether under glass or in the field. For the estimation of the duration of each stage it was extremely difficult to adopt any marking technique due to the fact that the insects seldom remained in the same place during development. They almost always migrated from place to place or died and disappeared. It was decided then to record the dates on which any change from one stage to another occurred. This was carried out on *Rubus fruticosus* and *Prunus persicae* both in the greenhouse and in the field. The records are given in Table I.

TABLE I

	GREENHOUSE		FIELD	
	RUBUS	PRUNUS	RUBUS	PRUNUS
Moulted to adults	2. IV. 1952	8. IV. 1952	20. IV. 1952	22. IV. 1952
Started oviposition	1. V. 1952	3. V. 1952	15. V. 1952	19. V. 1952
Hatching started	23. V. 1952	20. V. 1952	20. VI. 1952	9. VI. 1952
Moulted to second stage	16. VII. 1952	18. VII. 1952	17. VIII. 1952	17. VIII. 1952
Moulted to adults	28. III. 1953	9. IV. 1953	30. IV. 1953	27. IV. 1953

The duration of the different stages in days, could be estimated from the dates given above as shown in Table II.

TABLE II

	GREENHOUSE		FIELD	
	RUBUS	PRUNUS	RUBUS	PRUNUS
Preoviposition period	29	25	25	27
Incubation period	22	17	36	31
Duration of first stage	54	59	58	59
Duration of second stage	255	256	255	253
Duration of generation	360	366	374	370

The temperatures and humidities were recorded in both the field and the greenhouse throughout the duration of the generation (1952-1953) and are shown in the curves (Fig. 1). The following conclusions could be drawn from the given data.

(1) The incubation period of eggs is markedly different. It is 22 and 17 days in the greenhouse, and 36 and 31 days in the field on both *Rubus fruticosus* and *Prunus persicae* respectively. This could be easily explained on the basis of temperature which is higher at that period in the greenhouse than in the field. As could be seen from the curves the temperature of the greenhouse during the period 1.v.-23.v.1952 averages 61°F. and ranges from 57°F. to 68°F. The average temperature in the field during the period 15.v.-20.vi.1952 is 59°F. ranging from 55°F. to 61°F. This is also confirmed by the experiment discussed below and which was carried out to show the effect of temperature on the incubation period and morality of eggs.

(2) The fact that the durations of the first stage and the second stage

nymphs are nearly equal or even sometimes longer in the greenhouse than in the field is difficult to explain.

(3) There is no change in the duration of the generation as a whole and it appears that differences in temperature and humidity under glass are not sufficient to cause a change in the number of generations in that country.

With regards to the *E. taxi* on *Taxus baccata*, the life-cycle in general is similar to that of *E. corni*. The following points of difference however were observed.

(a) The nymphs are much less active than those of *E. corni* and they lose their power of locomotion much earlier (late in autumn).

(b) The nymphs settle on the lower surface of the leaflets of *Taxus* or on the lower side of the leaf stalk, where they remain until they moult into adults, a fact never observed in *E. corni*.

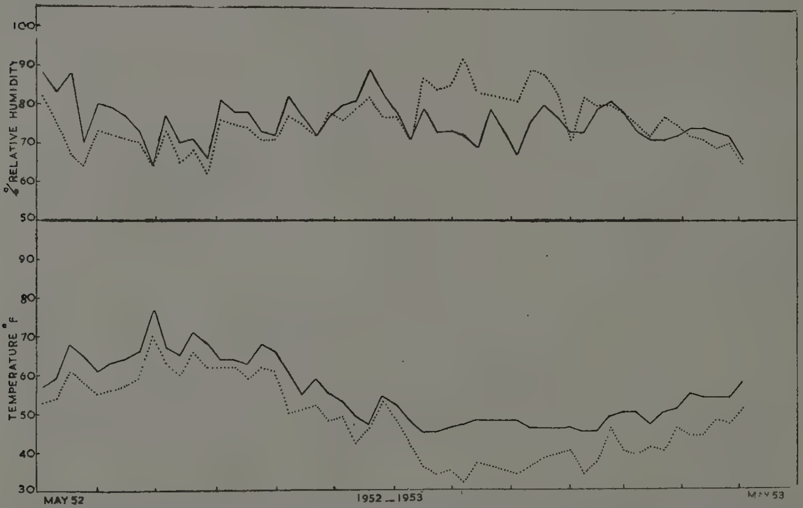

Fig. 1: Temperature and humidity throughout the duration of the generation 1952-1953 (straight lines for the greenhouse and dotted lines for the field).

(c) The dates of transformation from one stage to another are very similar to those of *E. corni*, and there is one generation a year.

(d) The percentage of males to the total population is very low and was estimated as 2% (3-5% in *E. corni* on *Cotoneaster*).

IV. EFFECT OF TEMPERATURE ON THE INCUBATION PERIOD AND MORTALITY OF EGGS

This experiment was carried out by incubating eggs at different temperatures ranging from 18-35° C. In each case three petri-dishes containing a counted number of eggs were used. Eggs taken were always those oviposited by the adult in the first day of oviposition to be under the same conditions.

Table III

TEMPERATURE IN oC.	INCUBATION PERIOD IN DAYS	RECIPROCAL OF INCUBATION PERIOD	PERCENTAGE OF MORTALITY
18	25	0.040	21
20	18.1	0.055	20
23	14.2	0.070	19
25	12.5	0.080	20
27	11.1	0.090	30
30	9.5	0.105	45
33	8.7	0.115	75
35	—	—	100

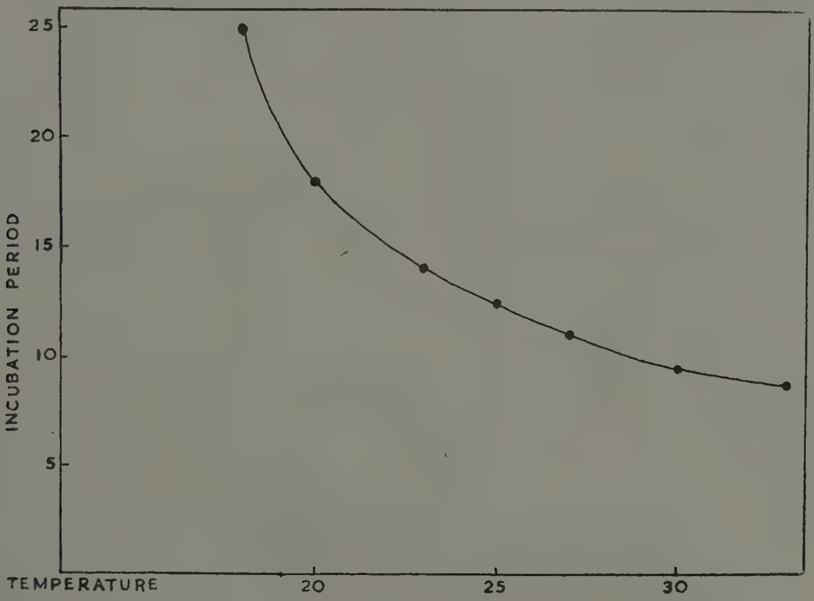

Fig. 2: Incubation period of the egg against temperature.

In each incubator, an open jar full of water was left beside the petri-dish, so that the eggs were always exposed to the same humidity (nearly saturation). In each case when the eggs started to hatch, the hatching nymphs were separated and counted daily. The dead eggs were also isolated and counted. Incubation period and mortality of eggs were calculated in each case and the results are given in Table III.

Plotting the temperature against the incubation period (Fig. 2), there appears a proportional decrease of the incubation period with the rise of temperature. The effect of changes of temperature however, is greater between the lower ranges than the higher.

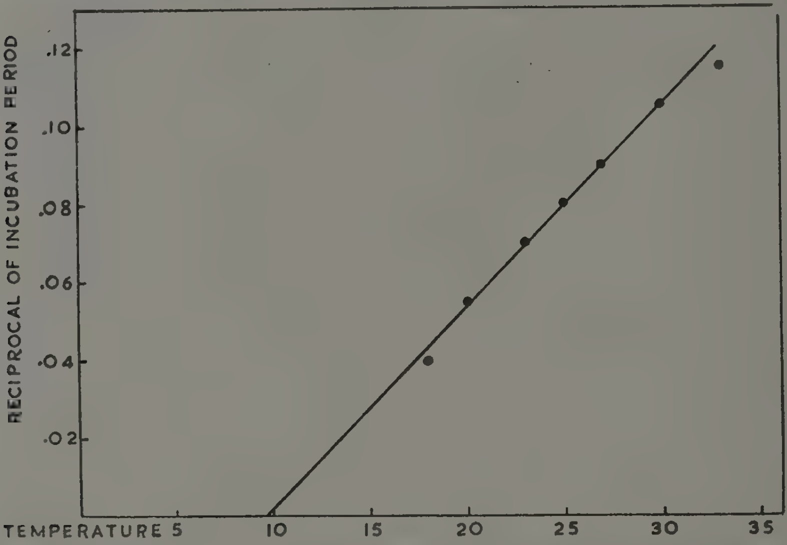

Fig. 3: Reciprocal of the incubation period of the egg against temperature.

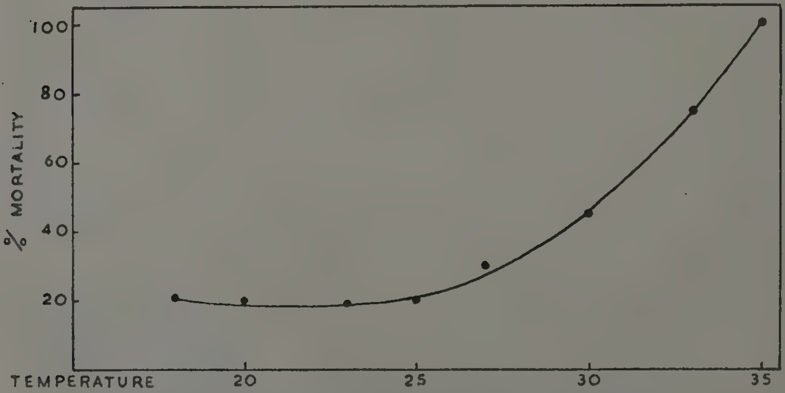

Fig. 4: Mortality of the eggs against temperature.

For obtaining the threshold the temperature was plotted against the reciprocal of the incubation period (Fig. 3). The curve obtained is nearly a straight line, which when extrapolated meets the co-ordinate of temperature at a point slightly less than 10°C.

Plotting temperature against mortality (Fig. 4), we find that the mortality is rather low and nearly equal at ranges of temperature between 18 and 25°C. It then suddenly rises steeply with rise of temperature until it reaches 100% at 35°C.

V. POPULATION DENSITY

It was observed that the population of this insect was always very low in spite of the fact that it markedly varied from one plant to another. The fact that the nymphs usually lived on the leaves and then migrated at the period of leaf fall to the twigs, drew attention to the possibility of the presence of some relationship between the nature of foliage of the plant and the population density of the insect living on it. It was decided then to study the population density on host plants with different foliage. Five plants were chosen for that purpose. The first two were ever-green plants namely *Cotoneaster microphylla,* and *Taxus baccata* (for *E. taxi*). The second two were deciduous plants namely *Prunus persicae* and *Ribes sanguineum.* The fifth plant was *Rubus fruticosus* in which the stem is biennial, giving rise, at the period of leaf fall, to new shoots with new leaves which remained during the following winter.

It was extremely difficult to estimate the mortality of the eggs and first stage nymphs in nature. Voukassovitch (1932) met the same difficulty in estimating the mortality percentage on peach in Yougoslavia, and started his estimation in July. He estimated the mortality to be about 80% by the end of the generation, and this was supposed to be under the most favourable conditions.

It was decided then to start counting from August, when the first stage nymphs moulted to second stages and could be easily seen settling on the leaves and branches. Counts of the surviving insects were made once every month continuously until the following May when all insects moulted to adults and started oviposition again. The counts were made on two plants in each case. In cases of *Rubus* and *Cotoneaster* it was easy to take counts from the whole bush, but in the other cases; two infested branches were chosen for counts and their bases were surrounded by a big piece of cotton wool forming a sort of barrier to prevent migration of nymphs from or to the branch.

The initial number of nymphs in each case was considered as representing 100 % population density and then the percentages of the surviving nymphs in each count was estimated accordingly.

The results are given in Table IV, and the curves are shown in Figures 5.

TABLE IV

DATE	TAXUS		COTONEASTER		RIBES		PRUNUS		RUBUS	
	NUMBER OF INSECTS	%	NUMBER OF INSECTS	%	NUMBER OF INSECTS	%	NUMBER OF INSECTS	%	NUMBER OF INSECTS	%
August	337	100	586	100	201	100	270	100	759	100
September	276	82	510	87	159	79	227	84	683	90
October	246	73	475	81	113	56	167	62	455	60
November	233	69	445	76	74	37	113	42	235	31
December	162	48	363	62	64	32	89	33	175	23
January	148	44	340	58	60	30	76	28	114	15
February	138	41	316	54	56	28	67	25	53	7
March	131	39	275	47	52	26	65	24	38	5
April	128	38	252	43	48	24	59	22	30	4
May	128	38	246	42	46	23	57	21	15	2

It is clear from the above figures and the curves that the population densities of these five plants at the end of the generation fall into three distinct groups.

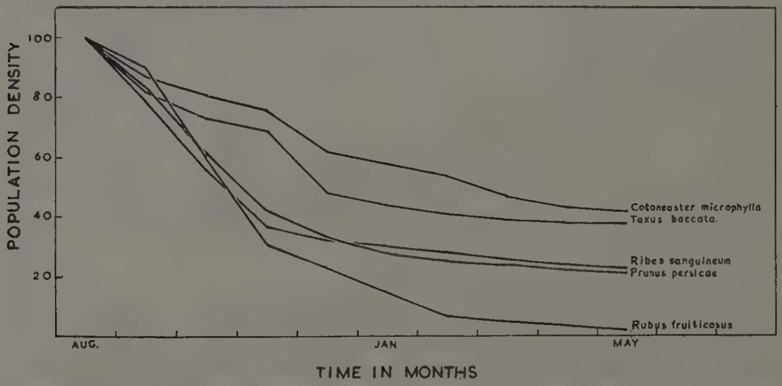

Fig. 5: The population density for *E. taxi* on *Taxus* and four different forms of *E. corni*, starting from the second nymphal stage (August to the end of the generation.

The first group, is that of *Cotoneaster* and *Taxus* in which the population density falls to about 40% (42 and 38% respectively). In the case of *E. taxi* on *Taxus,* it was observed that most of the nymphs settle on the lower surface of the leaflets where they remain till the adult stage. The drop of population percentage to 38% was mainly caused by the unfavourable climatic conditions. In the case of *Cotoneaster* the drop of the population percentage to 42% (highest percentage) could be explained by the fact that : (*a*) most of the second stages settle from the very begining on the twigs, and did not have to migrate from the leaves to the twigs as it is usually the case with *E. corni,* (b) being an ever-green plant, the leaves do not dry up, and the smaller number of nymphs settling on them had a better chance to migrate to the twigs, (c) the progeny of a sexual form might be more vital and resistant to adverse condition than the progeny of a parthenogenetic form.

The second group is that of *Ribes* and *Prunus* in which the population density falls to about 20% (23 and 21% respectively). The drop of population percentage in these two cases may be partly attributed to the leaf fall, and partly to the adverse climatic conditions. When leaves begin to dry, some of the nymphs succeed in migrating to the stems while most of the others remain static owing to the cold temperature, and perish when the leaves fall. It is worth mentioning here that an experiment was carried out, in which a zinc tray was put around the base of a *Rubus* bush, and the bush was covered by musling during the period of leaf fall. The falling leaves were collected and examined. All the nymphs settling on them were found to be dead, and this could be easily detected by the change of colour to dark brown, and by the fact that they could not be induced to move even by subjecting them to heat.

The third group is that of *Rubus* in which the population falls to 2 %. The drop of population density in this case could be attributed on one hand to the leaf fall and adverse climatic conditions, and on the other hand to the fact that some leaves grow on this plant on the new shoots and remain during winter. The repeated attempts of the nymphs to migrate towards these leaves expose them to bad weather conditions.

It is worth noting that the leaf fall in the case of *Ribes* and *Prunus* occurs earlier than in *Rubus,* subjecting the nymphs of the latter group to lower temperatures, thereby lessening their chance of successful migration.

In conclusion, it may be stated that there is a relationship between the foliage of a plant and the population density of *Eulecanium* living on it. On ever-green plants the population (40%) is higher than on deciduous plants (20%), ignoring the mortality of eggs and first stage nymphs which would of course have decreased these values to a much greater extent.

ACKNOWLEDGMENTS

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The behaviour of the nymphal stages of *Eulecanium corni* Bouché

[Hemiptera - Coccidea]

(with 13 Text-Figures and Tables I-VI)

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INTRODUCTION

The literature on the behaviour of Coccids in general, and on *Eulecanium corni* in particular is very scarce. The only author who dealt with the behaviour of this insect is Voukassovitch (1932). In general the results obtained by the writer agree with those of that author, but a more detailed analysis of some aspects of the behaviour has shown different results and somewhat different conclusions have been drawn.

The aim of this study has been to attempt to interpret the orientation behaviour of the early stages of this insect in terms of differing responses towards certain environmental factors. The factors investigated were, light, temperature, gravity, humidity, and some combinations of these. A series of experiments was carried out on the active stages, i.e. the second stage and the unfed first stage nymphs. The nymphs used were all from *Rubus fructicosus* except in a few cases where those from other plants (e.g. *Cotoneaster microphylla* or *E. taxi* from *Taxus baccata*) were tested.

SECOND STAGE NYMPHS

I. Light

A. Kinesis

The experiment was carried out in a constant temperature dark room (16-17° C). The apparatus used (Fig. 1) consisted of an electric bulb, the intensity of which was measured by a photometer (8.913 foot lamberts) under which was placed a pyrex glass trough full of water so as to absorb the heat

Bull. Soc. Entom. Egypte, XXXIX, 1955 (229).

given out by the bulb. The outer surface of the base of the jar was covered by filter paper in order to produce diffuse light. Below this, was placed a sheet of graph paper on which the released insects could move freely, the path of each insect being traced, marking the distance travelled in 15 seconds. This was repeated with 30 different insects ; three examples of such tracks are shown in Fig. 2A. The results were as follows :

Mean linear velocity per 15 seconds = 2.9 mms., range from 1 to 6 mms., standard error $e_a = \pm 0.0247$.

The same experiment was repeated with 30 other insects, under the same conditions except that the bulb was replaced by another one having higher intensity (125.9 foot lamberts). Three examples of the tracks are shown in Fig. 2B, and the results were as follows :

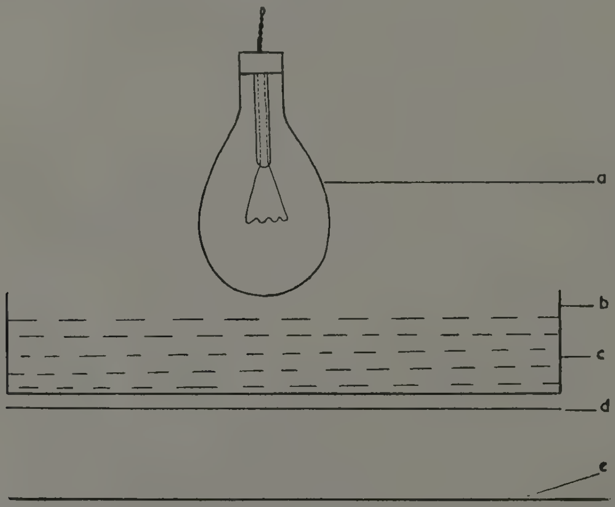

Fig. 1 : Apparatus used for the study of the effect of light « **Kinesis** ».
(a, electric bulb; b, pyrex glass jar; c, water; d, filter paper; e, sheet of graph paper).

Mean linear velocity per 15 seconds = 4.3 mms., range from 1 to 10 mms., standard error $e_b = \pm 0.0511$.

On comparing the significance between differences of means for the two light intensities, the following figures were calculated.

Standard error of the difference between means $e_d = \pm 0.05657$, D (difference between means) = 1.4, significance $= \frac{d}{e_d} = 24.74$.

This shows that the high light intensity has a very significant effect on the linear velocity (orthokinesis) of the nymphs.

The following facts appear to be important :

(1) The nymphs of *E. taxi* on *Taxus* are less active under both light intensities than those of *E. corni*. The mean linear velocity is 1.8 mms. per 15 seconds ranging from 1.0 to 3.5 under the low intensity and 2.9 mms. ranging from 1 to 7 mms. under the high intensity. If we add to this, the fact that these nymphs lose their power of locomotion very early before moulting to adults (late in December), when they could not be induced to move even by heat, while those of *E. corni* retain their power of locomotion

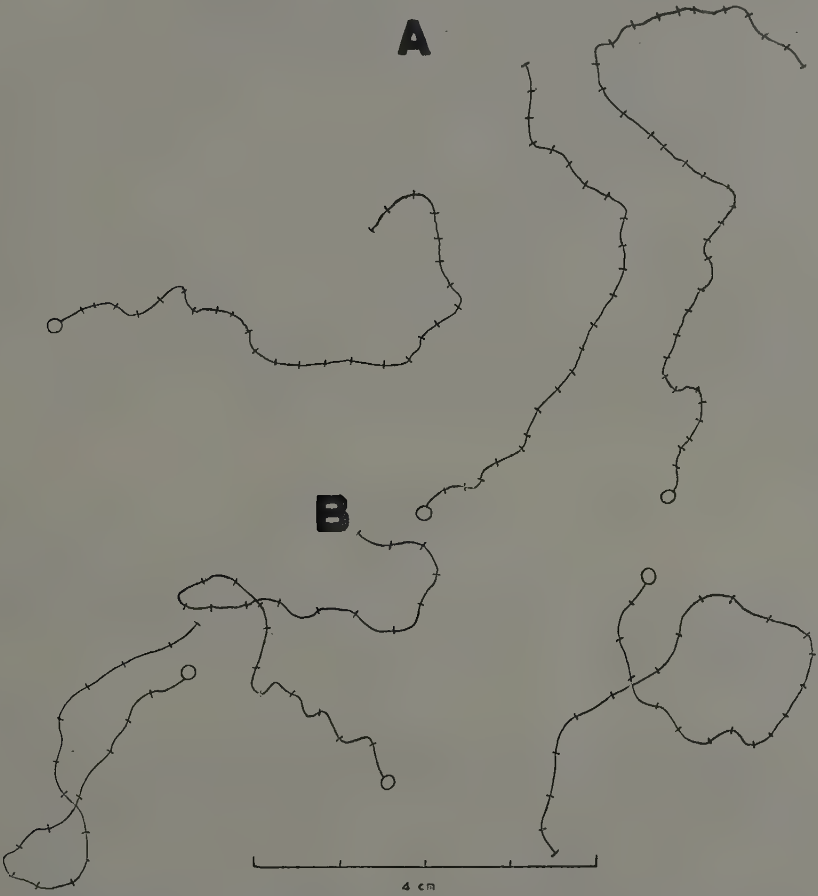

Fig 2 : Tracks of second stage nymphs marked at intervals of 15 seconds, under different light intensities.
((A) 8.913 foot Lamberts; (B) 125.9 foot Lamberts).

till just before moulting to adults, we find that the two species could also be separated on the basis of their behaviour paterns.

(2) The behaviour of *E. corni* collected from different host plants, towards this stimulus, shows no difference; except for the form, collected from *Cotoneaster microphylla,* where many of the nymphs were much more active under both light intensities. The writer considers this fact to be important, because it may be that the progeny of the sexual strain are more active than those of parthenogenetic one, especially as this is a more vital strain having the highest population density.

(3) The readings in the above experiment show the distances covered in 15 seconds actual movement, the intervals of rest being omitted. The following experiment was carried out on the resting periods. The nymph was left to move under the low light intensity for exactly five minutes and its track was traced on a separate graph paper, putting a mark on the track itself where the insect rested and writing the time of rest in seconds in front of each mark. After five minutes the low light intensity was switched off and the high light intensity switched on. The track was traced in the same way for another five minutes. The results of the experiments are given on Table I.

TABLE I

	FIRST EXPERIMENT		SECOND EXPERIMENT		THIRD EXPERIMENT	
	L.H.	H.I.	L.H.	H.I.	L.H.	H.I.
Total active period in seconds	182	210	185	212	179	213
Total resting period in seconds	118	90	115	88	121	87
Distance covered in centimetres	3.5	6.1	3.7	6.2	3.2	6.3
Number of intervals of rest	7	19	7	18	8	18

A representative track of the first experiment is shown in Fig. 3 from which it appars that the total active period is greater in the high light intensity (210 seconds), than in the low light intensity (182 seconds) and as the linear velocity is also higher, so the distance covered by the animal is also longer in high light intensity (6.1cms.) than in low light intensity (3.5 cms). Although the total resting period is less in the high intensity (90 seconds), than in the low intensity (118 seconds), yet the number of intervals of rest is more frequent in the first (19) than in the latter (7), the duration of resting intervals being much shorter, which shows that the insect is rather restless under high light intensity.

The duration of the resting periods also tends to get longer towards the end of the exposure to high intensity, and this might show a certain amount of adaptation to the new condition. It was also noticeable that the number of complete turnings is greater under high light intensity, which suggests that the light intensity does not only affect the orthokinesis, but has got also a klinokinetic effect.

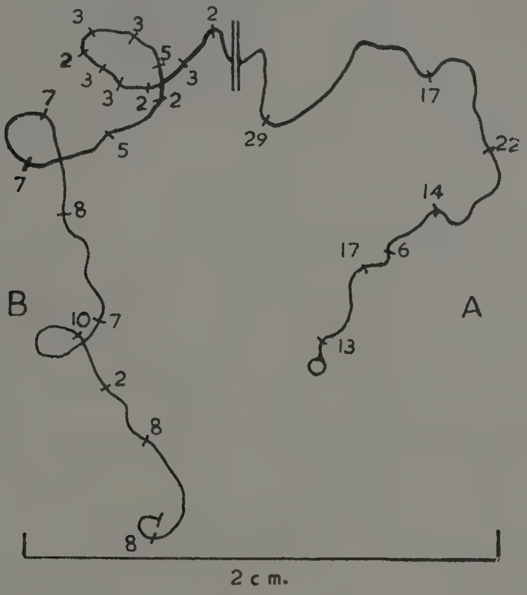

Fig. 3 : The track of a second stage nymph for ten minutes.
((A) under low light intensity for the 1st five minutes; (B) under high light intensity for the 2nd five minutes).
Figures and marks on the track indicate the resting periods and positions.

B. Taxis

Ten nymphs were placed on a sheet of paper, their original situations being marked (Fig. 4A). The paper was facing the window, the direction of light being shown by the arrow and was left for ten minutes after which the new positions of the nymphs were marked again. The nymphs were definitely photopositive. In order to avoid the window as a source of heat which is very effective on the insects as will be seen later, the following experiment was carried out. A tube was placed in the constant temperature dark room under diffuse light produced by the same apparatus as was used in the light kinesis experiment (B in Fig.). Five nymphs were introduced in the tube from a hole in its middle which was closed afterwards with selotape. Half of the tube was then covered by a black cover and after ten minutes the new situations of the nymphs were marked. Then the black cover was transferred to the other half of the tube, and after another ten minutes the new situations of the nymphs were marked again. The nymphs always moved towards the bright half, or in other words they are photopositive.

Another two experiments were carried out, in which two sources of light were used instead of one. Dim diffuse light was used to enable the writer to trace the tracks of the nymphs while moving on the black sheet of paper on which they were placed. At the begining of these experiments the two lights were put at a distance of one foot apart and the insects placed midway between the two sources at a distance of 20cms., but the insect did not show any particular response. Their movements were similar to those under diffuse light. The distances then had to be re-adjusted until at the end a position was obtained in which the insects responded. This was when the

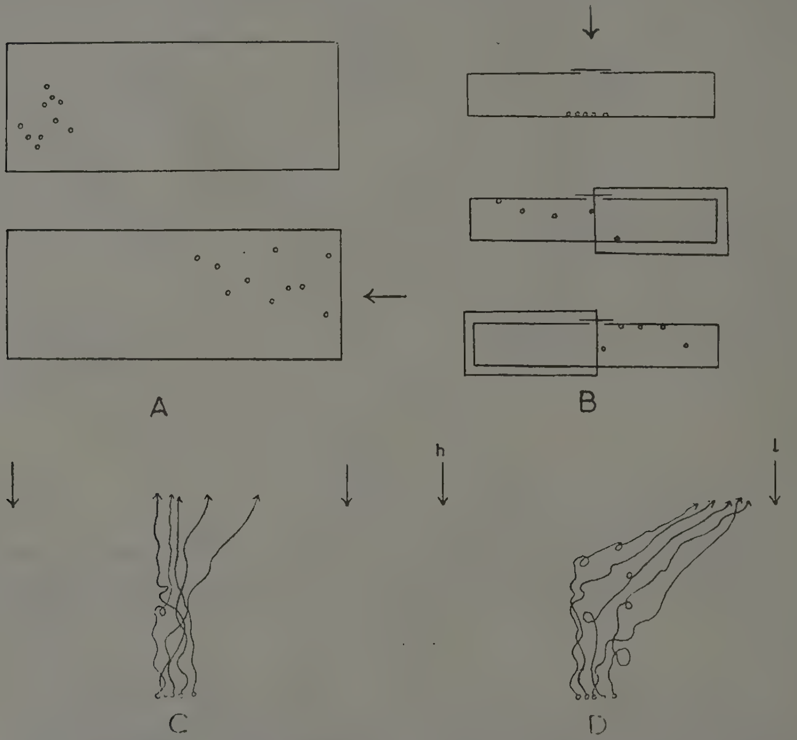

Fig. 4 : The effect of light « Taxis » (direction of light indicated by arrows). ((A) Original and final situations of ten nymphs on a sheet of paper facing the window; (B) original and final situations of five nymphs in a glass tube under diffuse light; (C) tracks of five nymphs moving between two sources of light of equal intensities; and (D) tracks of five nymphs moving between two sources of light of high (h) and low (l) intensities).

distance between the two sources was 14cms., and the insects at a distance not exceeding 9cms. away. When the two sources of light were of the same intensity the animals always moved in between both sources, the movement starting as a wavy path and ending in a rather straight line. Most of the nymphs responded positively, but a few moved away from the light. When one of the sources was of a higher intensity than the other, the insects moved for a short while towards the light, but the path then bent towards the low light intensity, apparently along the resultant of the two light sources. The examples of five tracks of each is shown in Fig. 4, C and D respectively.

C. Skototaxis

For this experiment a petri-dish (10cms. diameter) was used, the edge of which was covered with eight alternative upright strips of black and white paper. The dish was placed in the constant temperature dark room under diffuse light (33.11 foot lamberts). Fifteen nymphs were put in the middle of the dish and their original situations were marked. They were left to move for ten minutes and then the new situations were marked, and at the same time the track of only one of the nymphs was traced. This was repeated six times, and it was observed that when following the track of one of the nymphs it always moves first towards the upright dark patch, but it

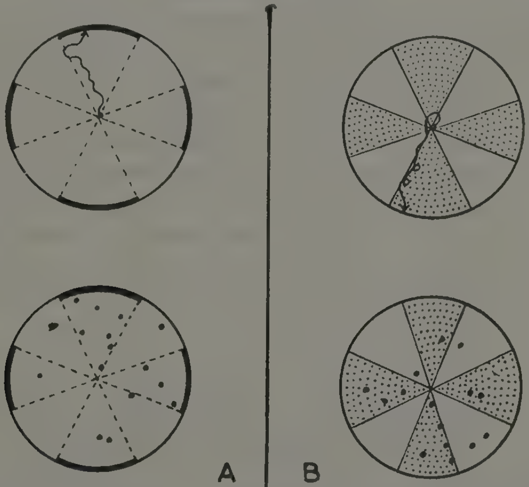

Fig. 5 : The effect of light « Skototaxis » (the track of one nymph and the final situations of 15 nymphs moving in a petri-dish under diffuse light (33.11 F.L.)).

((A) With alternative upright black and white strips of paper on the edge of the dish ; (B) with alternative horizontal black and white strips of paper below the dish).

never rests there, but continues migrating. However the final situations of the nymphs show to a great extent that they confine their migration to the parts opposite the dark patches. An example of one of the experiments is shown in Fig. 5A.

This experiment was repeated again, under the same conditions, but with a circular paper of the same diameter as that of the petri-dish, and divided into eight equal alternative white and black areas. The paper in this case was placed below the dish to show the effect of the horizontal dark objects. Again in this case when tracing the track of one of the nymphs, it has nearly always moved on the boundary between the dark and white areas, but the final situations of the nymphs after ten minutes showed that they were mostly confined to the horizontal dark areas. An example of one of the six replicates of this experiment is shown Fig. 5B.

II. Temperature

The apparatus designed for this experiment (Fig. 6) was made of a copper plate, so as to conduct heat, and the sides of this plate were bent down to form two upright stands, thus giving it the form of a table. The surface dimensions are 10×20 cms., out of which an area measuring 8×15 cms. was surrounded by a copper frame 2cms. high. A graph paper was placed on the floor of this area and the frame was covered by a glass cover having five openings which corresponded to five equal regions of the floor each measuring 3×8 cms. Each of these regions or compartments was in itself divided by the graph paper into three divisions each measuring 1×8 cms., and the openings were exactly opposite to the middle division of each

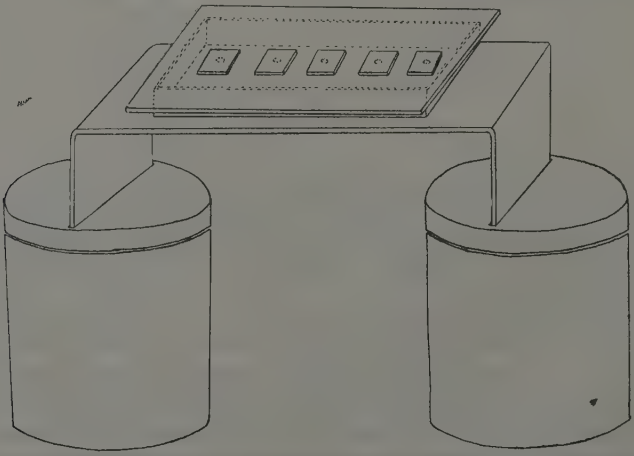

Fig. 6 : Apparatus used for the study of the effect of the temperature.

compartment. The openings were also covered with vaselined glass covers.

The stands on either side were put into two large beakers, the sides and the lids of which were covered with felt so as to maintain constant temperature as long as possible. The whole apparatus was also put into the constant temperature dark room, under diffuse light (33.11 foot lamberts).

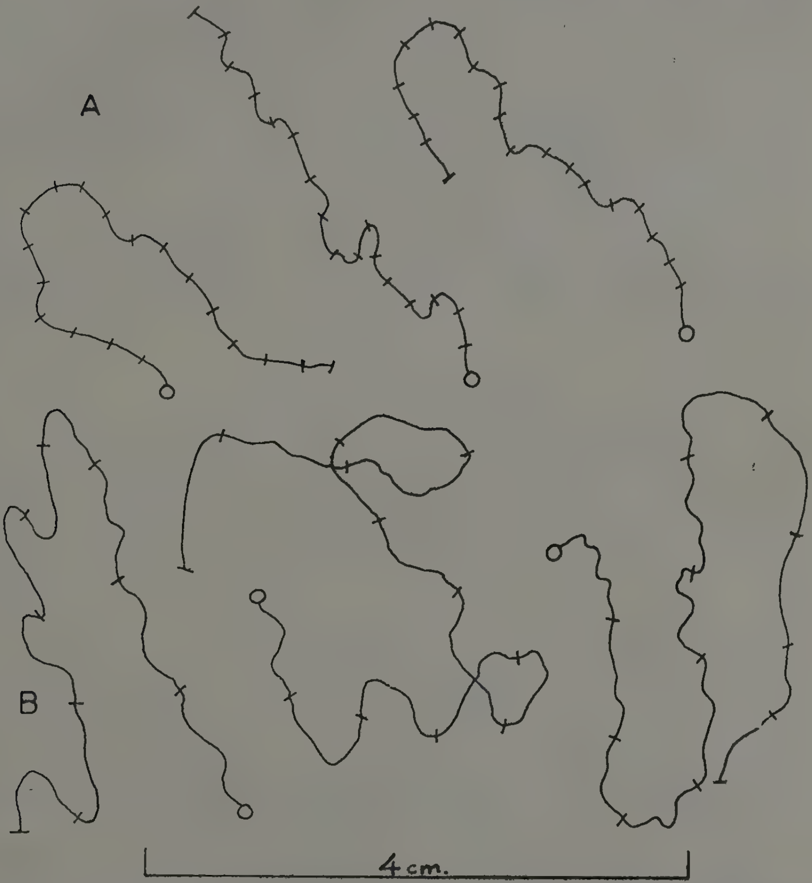

Fig. 7 : Tracks of second stage nymphs marked at intervals of 15 seconds, under the same light intensity (33.11 F.L.), but different temperatures. ((A) 14-15° C.; (B) 26-27° C.)

The two beakers in the first set of experiments were filled with cold water, and the temperature of the floor of the apparatus was measured with an electric thermocouple through the openings. It kept fairly constant and ranged between 14 and 15°C. One nymph was placed in the middle of the floor and its track was traced on a separate graph paper, putting a mark on the track after each 15 seconds of acutual movement. This was repeated with 20 different nymphs.

In the second set of experiments the beakers were filled with hot water but in this case it was noticed that the temperature of the floor decreased slowly in spite of all precautions taken and so the work was always started whenever the temperature reached 27°C. and stopped whenever it fell to 26°C. In other words the range of temperatures was always between 26 and 27°C. The same experiments were repeated with 20 other nymphs. Three representative tracks of each are shown in Fig. 7A and B.

The results showed that the mean linear velocity per 15 seconds in the first case is 2.5 mms. ranging from 1.5 to 4.0 mms., while in the second case it is 9.2 mms. per 15 seconds, ranging from 3.5 to 13.0 mms., which is clearly significantly different. Thus the temperature has a great effect on the linear velocity.

Temperature preference

In the third set of experiments, the same apparatus was used, but with one beaker full of iced water and the other with hot water (40°C.) The temperatures of the five compartments were measured by the electric thermocouple inserted through the openings and were found to be 9.5, 12.5, 16, 21 and 27°C. respectively. These temperatures never kept constant for more than 12 minutes, after which they began to fall gradually. It was decided to take three readings only, one after four minutes, one after eight minutes and the third after 12 minutes. After this the water in both beakers had to be changed. Five nymphs were released through each opening and their original positions were marked on separate sheets of paper divided in the same ways as the floor of the apparatus, and the new positions were then marked after each of the previously mentioned three periods. This was repeated six times. A typical diagram of this experiment is shown in Fig. 8. The totals of the six experiments are summarised in Table II.

From this Table and from the histograms shown in Fig. 9, it appears that there is continuous migration from the colder side towards the warmer

TABLE II

TIME IN MINUTES	COMPARTMENT I			COMPARTMENT II			COMPARTMENT III			COMPARTMENT IV			COMPARTMENT V		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
0	—	30	—	—	30	—	—	30	—	—	30	—	—	30	—
4	1	26	4	8	11	11	7	14	10	7	13	13	14	9	2
8	2	24	3	4	9	5	10	11	12	11	18	18	15	8	2
12	—	24	4	2	4	5	4	8	10	6	20	35	19	8	1

side. Two clear aggregation regions appear at the end of the last period, the first being in the middle division of the 1st compartment the temperature of which is 9.5°C. and which could be explained by immobilisation of the insects at this temperature, and the second in the divisions at a temperature higher than 21°C. and lower than 27°C., which could be the preferred temperatures of the nymphs.

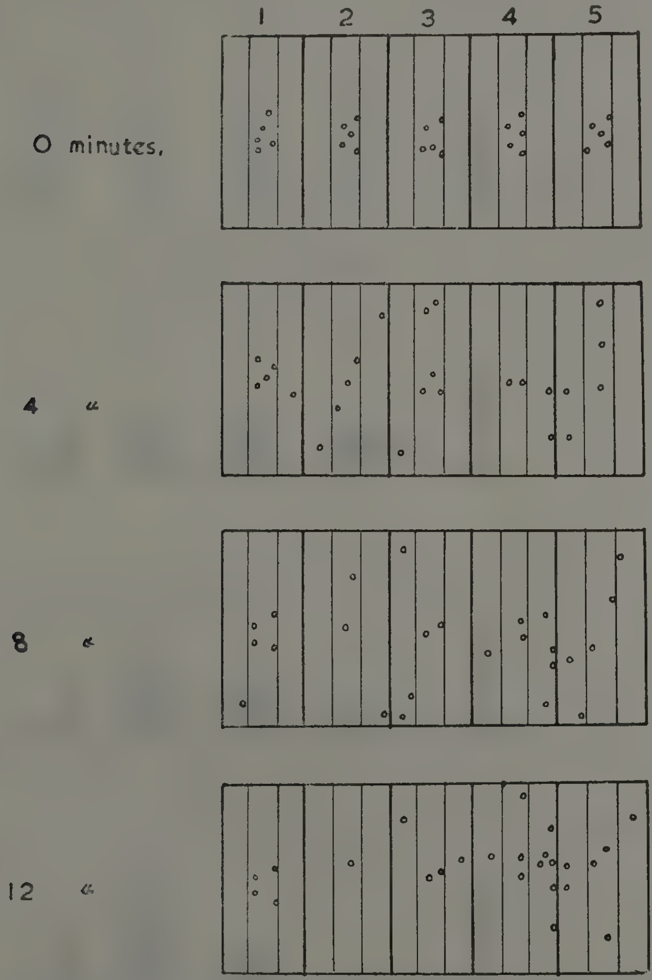

Fig. 8 : Diagram to show the positions of the nymphs on the floor of the apparatus after the indicated periods. Temperature of compartments: (1) 9.5°C.; (2) 12.5° C.; (3) 16° C.; (4) 21° C.; and (5) 27° C.

III. Gravity

A. Gravity

Ten nymphs were placed on a sheet of cardboard and their original positions were marked on another sheet. The cardboard sheet was kept in a vertical position in complete darkness for 15 minutes after which the light was switched on and the new positions of the nymphs were marked again.

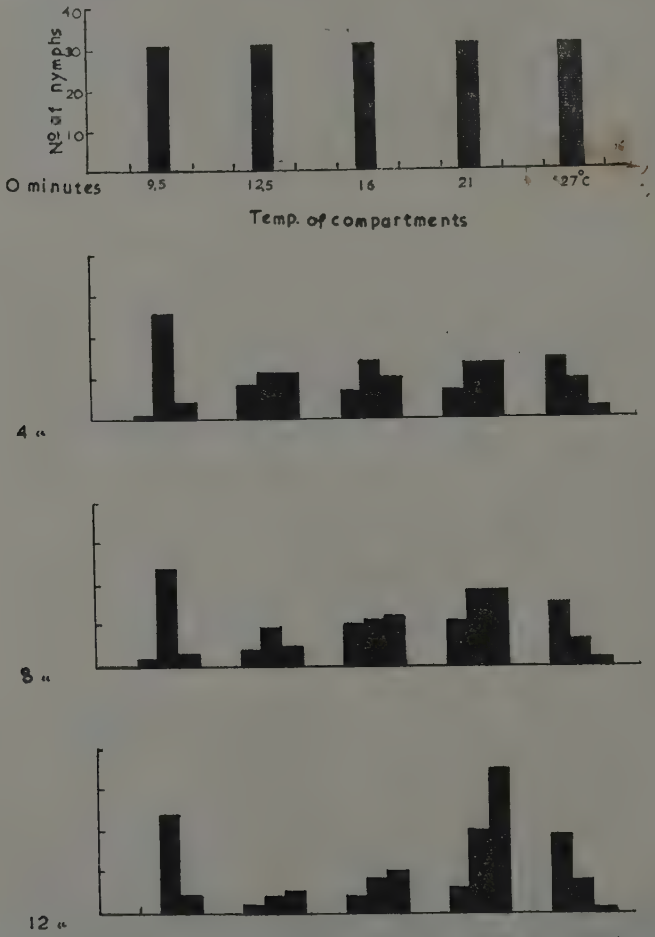

Fig. 9 : Histograms showing the distribution of the nymphs on a temperature gradient after the indicated intervals.

The cardboard was reversed upside down and left again in complete darkness for another 15 minutes after which the new positions were marked again. As appears from Fig. 10A, the nymphs always moved downwards, or in other words they are positively geotactic. The same result was obtained when using a glass tube instead of the cardboard sheet as seen in B of the same Figure.

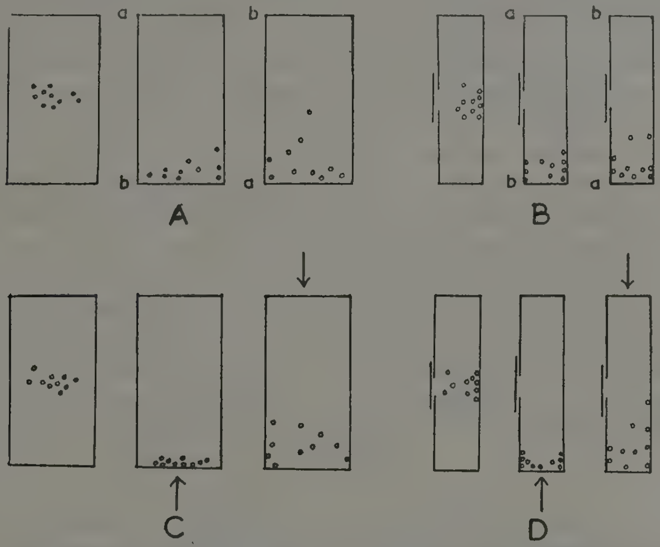

Fig. 10 : Dominant effect of gravity on light.
((A) original and final situations of 10 nymphs on a vertical flat surface in complete darkness; (B) same as (A) in a glass tube; (C and D) same as (A and B) with directed light from above and below).

B. Light and gravity

The same experiments were repeated but with light directed either from above or from below. When both light and gravity were reacting in the same direction, the aggregation of the nymphs on the lower part of either the sheet or the tube was very clear. In the case when the light was directed from above, there was still a downward movement of the nymphs but to a lesser degree. That appears to mean that the nymphs of this instar react more strongly to gravity than to light. The positions of the nymphs are shown in both cases, C and D of Figure 10.

C. Resting position

Two facts attracted the attention of the writer. The first was that whenever the nymphs were left in a petri-dish or any container, they always rested either vertically on the side walls or upside down on the roof of the container. Secondly, whenever the leaves infested with the nymphs in this stage were collected, they were usually left after examination in the petri-dish with their lower surfaces facing upwards and overlapping each other. It was then noticed that the majority of the nymphs migrated to the upper surfaces of the overlapping leaves which were facing downwards, and again came to rest upside down. Two experiments were carried out in this connection.

(1) In the first experiment 10 infested leaves on different bushes of *Rubus fruticosus* in the field were twisted and fixed upside down, so that the insects were resting in a dorso-ventral position. On the next day the leaves were re-examined, and it was found that only a few of the inscets migrated to the upper surface which was facing downwards, while a great number remained on the lower surface (facing upwards), the majority of them being dead. This high mortality could be explained by the unfavourable climatic conditions which prevailed at that time. This explanation appears likely to be true because when the experiment was repeated in the greenhouse, it was found that the majority of the nymphs migrated to the under side, only a few remained on the upper side, but they were all alive. In both cases there were a few nymphs missing, and it was impossible to tell whether they died and dropped off or whether they migrated to other parts of the plant.

(2) To avoid the interference of the light factor in this experiment, a second experiment was carried out. A leaf of *Rubus fruticosus* was fixed in a horizontal position in the constant temperature dark room. In alternate experiments the light was directed onto the upper and lower surface of the leaf respectively, either by turning the leaf upside down or by altering the position of the light source. The nymphs were released by a very fine needle on the petiole of the leaf and left to move, and in nearly all the cases in which they succeeded in moving in the direction of the blade of the leaf, they moved toward the lower side, whether it was the actual lower surface or the upper surface of the leaf, and regardless of the direction of the light.

In some cases the nymphs moved for a while on the upper side, but they never settled there, and continued moving until they came to the edge of the blade where they turned to the lower side. These two experiments show that the primary orientation of the nymphs in this stage in relation to gravity is ventro-dorsal.

IV. Humidity

A petri-dish with a divided floor was put in the constant temperature dark room (16-17°C.), under diffuse light (33.11 foot lamberts). One side of the dish was filled with water and the other side with solid pieces of KOH. The bottom was covered with perforated zinc to which very fine muslin was attached so as to form a substratum fit for the nymphs to move on and at the same time allowed for the setting up of a humidity gradient. The dish was vaselined at its edges and was covered with a glass cover with an opening in its centre which was covered in its turn by a vaselined piece of glass. Ten nymphs were released from the opening in the centre of the dish, and counts were made after four intervals of 5, 10, 15 and 20 minutes respectively on the wet and dry sides and in the middle zone between them. This was repeated six times, and the totals of the results are given in Table III.

TABLE III

TIME IN MINUTES	WET	MID	DRY
0	—	60	—
5	9	24	27
10	7	19	34
15	6	15	39
20	4	15	41

This shows that the nymphs reacted to humidity by moving towards the dry side, or in other words avoided saturation.

Humidity preference

The apparatus designed for this purpose (Fig. 11) consisted of a long narrow zinc tray (6×30 cms.). At each end of the floor of this tray is a wide opening (3cms. diam.), covered from the inner side with perforated zinc and fine muslin, and fitted from the outer side to a specimen tube. The tube at one end was filled with water and the other was filled with solid KOH. A long ribbon of cobalt thiocynate paper was stretched all along the tray

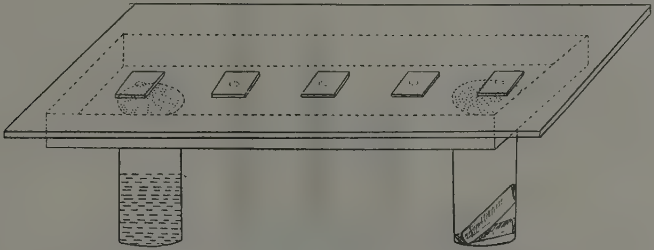

Fig. 11 : Apparatus used to study the effect of humidity.

below the vaselined glass cover, to measure the range of relative humidity in its different regions.

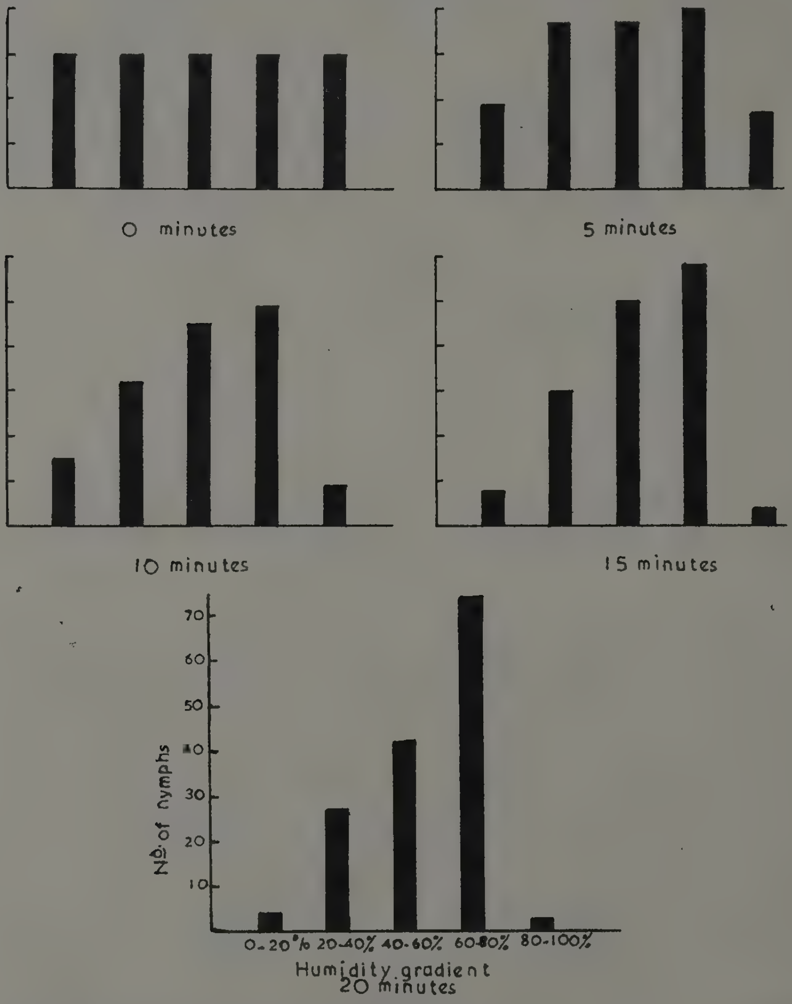

Fig. 12 : Histograms showing the distribution of the nymphs on a humidity gradient after the indicated intervals.

By this method it was possible to divide the tray into five successive regions in which the relative humidity ranged from 0-20%, 20-40%, 40-60%, 60-80% and 80-100%. In the centre of each of these regions an opening was bored in the glass cover. The openings were also covered with vaselined pieces of glass. This apparatus was put under the same conditions as in the previous experiment (16-17°C. and 33.11 foot lamberts light intensity), and five nymphs were released in each of these openings. Counts were made in the five regions, at the same intervals (5 minutes) as were used in the last experiment. This was repeated six times and the totals of the results are given in Table IV.

TABLE IV

TIME IN MINUTES	0 - 20 %	20 - 40 %	40 - 60 %	60 - 80 %	80 - 100%
0	30	30	30	30	30
5	19	37	37	40	17
10	15	32	45	49	9
15	8	30	50	58	4
20	4	27	42	74	3

These results represented in the form of histograms (Fig. 12), show that more insects aggregate in the region of 60-80% R.H., than in any other region. The histograms at the end of the experiments are very steep towards the saturated end, gradually sloping towards the dry end, having fewer nymphs in the regions of 20-40% and 40-60% R.H. In other words, outside the optimum, the nymphs are more tolerant of the drier regions than of the extreme saturated region.

A third experiment was carried out under the same conditions, but the water and the KOH in the tubes were substituted by two KOH solutions of different concentrations so as to give a humidity gradient in the tray ranging from 40-80%, thus avoiding extreme driedness and saturation. The tray was divided into 4 regions with relative humidities of 40-50%, 50-60%, 60-70% and 70-80% respectively. A new glass cover was used with only 4 holes corresponding to the 4 regions. The experiment was repeated six times. The totals of the results obtained are given in Table V.

TABLE V

TIME IN MINUTES	40 - 50 %	50 - 60 %	60 - 70 %	70 - 80 %
0	30	30	30	30
5	22	38	41	19
10	20	32	54	14
15	13	24	76	7
20	9	23	82	6

These results show that the optimum humidity, in which the highest aggregation of nymphs occurs at the end of the experiment is the 60-70% R.H. The curve shown in Fig. 13, however still shows to be steeper towards the 70-80% side while gradually sloping towards the relatively drier side, which shows again that the nymphs are comparatively more tolerant of lower humidities.

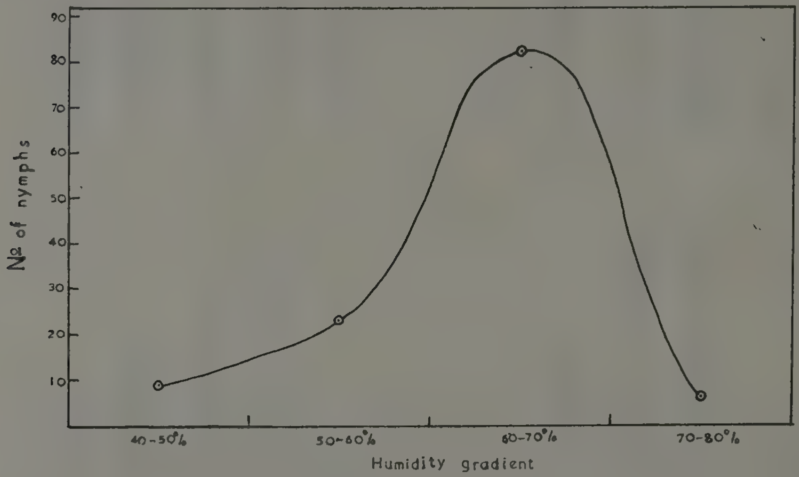

Fig. 13 : Curve showing the distribution of the nymphs on a humidity gradient.

Unfed first stage nymphs

All the previous experiments were repeated with unfed nymphs obtained from the incubated eggs, taken from adults collected from *Rubus fruticosus*. It was found more practical to summarise the results of these experiments as follows.

I. Light

A. *Kinesis*

There was no significant difference between the means of linear velocity under the two light intensities. The means were 4.4 mms. per 15 seconds, ranging from 1-7 mms. in case of low light intensity, and 4.3 mms. ranging from 1-6.5 mms. in case of high light intensity. The experiment was carried out at the temperature of 20-21°C., but using the same light intensities as with the second stage nymphs, i.e. 8.913 and 125.9 foot lamberts respectively.

B. *Taxis*

The nymphs are highly photopositive, and in the two light experiments, they behaved in the same way as the second stage nymphs, moving along the resultants of the two light intensities.

TABLE VI

FACTOR	SECOND STAGE NYMPHS	UNFED FIRST STAGE NYMPHS
Light kinesis . . .	The linear velocity is higher at high light intensity and the insects show inclination to the low light intensity.	Linear velocity is similar under both light intensities.
Light taxis. . . .	Photopositive and attracted towards the low intensity source probably along the resultant of the two sources.	Highly photopositive and aslo attracted towards the low intensity source.
Light skototaxis . .	Attracted towards both upright and horizontal dark objects.	Indifferent.
Temperature . . .	Strongly affects the linear velocity and there is preference for warmer places. Cold causes immobilisation.	The same.
Gravity	Positively geotactic.	Indifferent.
Light and gravity .	Gravity has more influence.	Light has more influence.
Humidity	Optimym 60-70 0/0 R. H., but comparatively more tolerant of drier conditions.	The same.

C. *Skototaxis*

The nymphs were indifferent to both upright and horizontal dark objects. They moved in the dish in both cases, in the same way as they moved under diffuse light without any dark stripes.

II. Temperature

This has the same marked effect as on the second stage nymphs. In the 1st experiment the mean linear velocity rose from 2.1 mms. per 15 seconds: ranging from 1.2 to 3.9 mms., to 8.7 mms. per 15 seconds, ranging from 3.2 to 11.8 mms. when the temperature was changed from 14-15°C. to 26-27°C. In the second experiment of temperature preference, the 1st stage nymphs also aggregated in the compartments between 21°C and 27°C., and were immobilised at a temperature of 9.5°C.

III. Gravity

The nymphs were indifferent to gravity, and when the light-gravity experiment was carried out they always moved towards the light regardless of the direction of gravity. This means that the insects react more strongly to light at this stage than they do to gravity.

IV. Humidity

The first stage nymphs behaved in more or less the same way as the second stage nymphs, showing always :

(a) Avoidance of extreme saturation and dryness; (b) an optimum humidity range from 60-70%, and (c) more tolerance of drier conditions.

A comparison of the two stages of nymphs in their behaviour towards these factors is shown in Table VI.

CONCLUSIONS

On attempting to interpret the orientation behaviour of the different stages of this insect in terms of differing responses towards the above studied environmental factors, one can draw the following conclusions.

(1) The first instar nymphs exhibited a strong positive reaction to light (positive phototaxis). They appear indifferent to gravity. This light reaction appears to be the mechanism by which they find their first habitat on a plant, i.e. the tips of the branches.

(2) The second instar nymphs although still positively reacting towards light, are activated by high light intensities (i.e. are strongly photokinetic), simultaneously there is a progressive increase in the reaction to gravity. It appears that the positive geotaxis together with activations by light combine with other possible factors (e.g. trophic and thigmotactic), to direct the insects in this stage to their second habitat on the plant, i.e. on the lower surfaces of the leaves, on the lower surfaces of the horizontal branches and on the lower shaded parts of the vertical stems.

(3) As well as photokinesis the second instars exhibit strong preference for both upright and horizontal dark objects (skototaxis) and this may reinforce the two other reactions and direct the insects towards the darker parts of its habitat.

(4) In the second instars the primary orientation of the nymphs is changed from the dorso-ventral (dorsum uppermost) to ventro-dorsal (ventra uppermost) and the insects tend to be orientated upside down, and this together with geotaxis and photokinesis may account for the frequence of occurence of the insects in these habitats.

(5) As would be expected, higher temperatures increase activity both in the laboratory and outdoor observations. One sees the insects moving on warm days. There appears to be a zone of preference between 21 and 27° C. in which the insects tend to aggregate.

(6) The humidity reactions are the most difficult to interpret in terms of behaviour on the natural habitat. In laboratory conditions both instars tend to aggregate between 60-80 % R.H., avoiding the zone of saturation and very low humidities.

It is evident from these conclusions that a large part of the orientation of this insect in natural habitats can be explained in terms of their responses towards light, gravity and temperature. It is difficult to correlate the orientation completely in terms of environmental factors, though the effect of humidity is uncertain and requires further study.

ACKNOWLEDGMENT

This work was carried out in the Silwood Park Field Station, Berkshire, England, and the writer wishes to express his thanks to Drs. W.F. Jepson and N. Waloff of the Imperial College for their guidance and consistent help.

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Studies on *Coccinella undecimpunctata ægyptiaca* Reiche

I. PRELIMINARY NOTES AND MORPHOLOGY OF THE EARLY STAGES

[Coleoptera : Coccinellidae]

(with 44 Text-Figures, and 1 Table)

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Entomological Section, Ministry of Agriculture, Cairo.

CONTENTS

Introduction. — Historical review. — Systematic position and synonymy. — Geographical distribution. — Host insects and host preference. — Method and technique. — Morphology of the early stages : egg, larval instars, pupa. — Summary. — Acknowledgments. — References.

INTRODUCTION

Coccinella undecimpunctata L. is one of the best known and most widely distributed Coccinellid beetle in Egypt. It has attracted the attention of both entomologists and laymen because of its abundance and beneficial habits. The adults and their early stages are often encountered in large numbers on the plants infested with aphids. They prey on these harmful insects and often play a certain role in bringing them under control. The beetles are very common on cotton plants in June and July, but they gradually decrease in numbers with the rise of temperature, the increase of growth of plants and the decline in aphid infestation. They almost disappear in late summer when they migrate to maize fields and other plants infested with aphids.

The author was prompted by the scarse information about this important insect to undertake its study and to elucidate many of the relevant facts about it. In an earlier work, the present writer (1948) dealt with the morphology and anatomy of the adult insect. The present work is a detailed study of the early stages of this predator.

HISTORICAL REVIEW

Aside from few taxonomic studies and a description of the Egyptian race, the literature dealing with *Coccinella undecimpunctata* L. is very scanty. Hawkes and Marriner (1927) recorded that Lewcock (1892) tried to rear a larva of the beetle on « garden aphids », but he failed. Chitty (1893) remarked that larvae of the beetle occur in salt marshes under sea weed, rubbish, etc., but he failed to find out what they usually feed on. Donisthorpe (1903) stated that he found adults, pupae and larvae of the beetle on sand hills in Calway and that the larvae were found feeding on aphids infesting *Lotus corniculatus.* Hawkes and Marriner (1927) found the eggs of the beetle in horse and cow dung and stated that beetles had eaten split raisins and *Phyllaphis fagi* L. Dobzhanski (1931) made very few remarks on the description of the adult insect and mentioned that the species lived only along the sea coasts of Europe, on saline soils of Middle and Central Asia and along the coast of the Polar Ocean.

Very few observations were also made on the beetle in Egypt. Adair (1918) reported that the insect fed on Jassids. Willcocks (1925 and 1937) made a record of some hosts of both adults and larvae. Bishara (1934) made few observations on the host preference of the beetle and concluded that it preferred aphids. The writer (1938) studied the morphology and anatomy of the adult insect. Kamal (1951) commented on its hosts and made few observations on its biology.

SYSTEMATIC POSITION AND SYNONYMY

Coccinella undecimpunctata L. was described for the first time in « Systema Naturae » (1758). Thunberg (1795), however, described it again and gave it the name *Coccinella triangularis.* To the writer's knowledge this is the only synonym of *undecimpunctata* L. Reiche (1861) described the Egyptian race *aegyptiaca*, which differs from the typical *undecimpunctata* by the posterior extension of the two creamy white patches located on the side of the prothorax (Fig. 1). Several aberrations which differ from each other by the number and way the black dots of the elytrae are united, do occur in Egypt. Ibrahim (1948) recognised more than ten of such aberrations.

GEOGRAPHICAL DISTRIBUTION

The insect is rather cosmopolitan in its distribution. It is reported to occur in Alaska (Dobzhanski, 1931), Astrachan (Sacharov, 1915), Egypt (Willcocks, 1922, 1937), England (Smee, 1922), Malta (Borg, 1931), Massachusettes, U.S.A. (Franklin and Cross, 1941), New-

Zealand (Gourlay, 1931) and the Sudan (Cottam, 1922). It was reported to occur along the sea coasts of Europe, on saline soils of Middle and Central Asia, and along the cost of the Polar ocean, from Greenland to the mouth of Yeniser (Dohzhanski, 1931).

In Egypt it is very common in Upper and Lower Egypt, both in the Nile Valley and in the desert.

HOST INSECTS AND HOST PREFERENCE

The beetle is rather carnivorous in its feeding habits. It preys on eggs, larvae and adults of many species of insects. It is, however, most important as a predator on aphids. It was reported to be responsible, in association with other species of Coccinellidae, for the control of *Toxoptera aurantii* Boy., in Malta (Borg, 1931). It was introduced in 1874 from England into New Zealand in an attempt to control different species of aphids (Sweetman, 1936). The following insects are reported as hosts of *Coccinella undecimpunctata* L. :

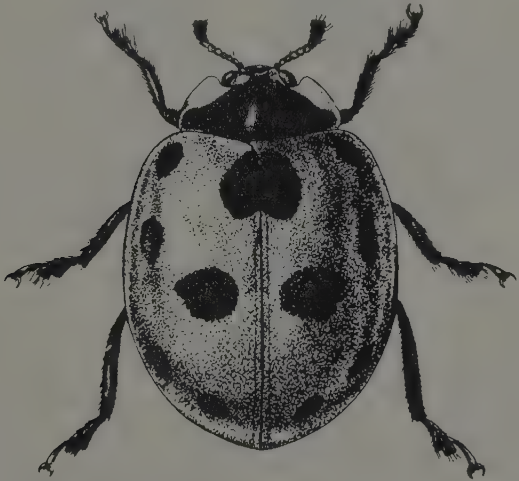


Fig. 1 : *Coccinella undecimpunctata* L., x 10.

Lepidoptera : *Prodenia litura* F. (eggs and larvae), Egypt ; *Epipyrops* spec. (eggs), India. — Hemiptera : Jassid gen. spec., Egypt ; *Aphis gossypii* Glover, Egypt ; *Aphis maidis* Fitch., Egypt ; *Aphis sorghi* Theo., Egypt and Sudan ; *Aphis laburni* Kalt., Russia ; *Macrosiphum granarium* Kirby, Egypt ; *Toxoptera graminum* Rond., Egypt ; *Toxoptera aurantii* Boy., Malta ; *Myzus scamelli* Mason., U.S.A.

The following species of Aphids were successfully used by the author during the laboratory breeding work as hosts for the beetle: *Aphis durantae* Theo., *Aphis gossypii* Glover, *Aphis laburni* Kalt., *Aphis pseudobrassicae* Davis, *Aphis maidis* Fitch., *Aphis nerii* Boy., *Hyalopterus arundinis* F., *Macrosiphum sanborni* Gill., and *Myzus persicae* Sulz.

When larvae of the beetle, however, were provided in confinement with honey, *Prodenia* eggs, young *Prodenia* larvae, nymphs of the mealy-bugs *Pseudococcus filamentosus* Ckll. or *Phenacoccus hirsutus* Green, they either refused to feed or fed for a very short time, but failed to complete their development.

METHOD AND TECHNIQUE

In order to make a thorough study of the morphology of the early stages of the beetle, it was found necessary to breed it under laboratory conditions. The following method was found very satisfactory for mass breedings.

A number of adults were confined for oviposition in a cage 30x30x30 cm. The frame and bottom of the cage were made of wood, while the top and three sides were covered with fine wire gauze. On the front side there was a movable glass door which slides vertically within two lateral grooves. A water bottle with *Duranta* sprigs infested with aphids was placed in the cage to provide the beetles with a sufficient supply of suitable host material. The water and sprigs were changed daily. The walls and contents of the cages were checked twice every day for egg-masses which might have been deposited. Egg-masses were generally laid on the plant springs. Eggs were transferred to breeding cages which were similar to the oviposition cages. Because of the cannibalistic habits of the adult, it was necessary, especially when there was a severe shortage of host food, to remove the eggs as soon as they were laid, i.e., several times daily.

When the eggs were about to hatch, a water bottle provided with plant sprigs infested with aphids was placed in the breeding cage. In order to provide the developing larvae with sufficient food throughout their developmental period, it was necessary to increase the amount of food with the advance of their development. When about to pupate, the larvae ceased to feed and thus no food was provided for them. As soon as the adults emerged, they were transferred to oviposition cages where they mated and deposited their eggs.

MORPHOLOGY OF THE EARLY STAGES

The egg

The egg (Fig. 2) is spindle in shape with both ends slightly rounded. The surface is smooth and devoid of reticulations. Immediately after deposition, the egg is orange yellow in colour. Newly deposited eggs are uniform in their colouration. Since the chorion is transparent white, the egg acquires the colour of its contents. It undergoes certain changes in colouration before hatching. After hatching the chorion appears as a tarnsparent white empty shell (Fig. 3).

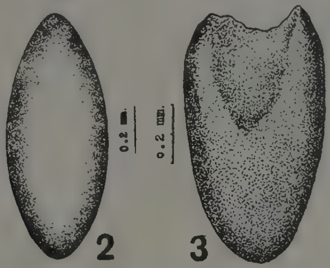


Fig. 2 : The egg. — Fig. 3 : Egg shell after hatching.

On the bases of measurements taken for fifty eggs, the average length of the egg is 0.88 mm. with a maximum of 1.0 mm. and a minimum of 0.72 mm., while the average width at the widest part is 0.40 mm. with a maximum of 0.44 mm. and a minimum of 0.36 mm.

The larval instars

The larvae are elongate and are mottled with white and yellow areas and covered with short spines. The writer found that there are four larval instars, while Kamal (1951) stated that *Coccinella undecimpuctata* L. has three larval instars only. When the larva is about to moult, it attaches itself with its caudal end to a solid support. After moulting, it crawls out leaving its exuvium attached to the support.

A description of each larval instar is given hereafter.

The first instar larva

Just before hatching the larva within the egg chorion could be easily discerned under the binocular. The larva breaks its way out from the egg-shell rather than eating it through. The newly hatched larva is light yellow in colour. It gradually becomes darker, especially on the dorsal surface which always looks darker than the ventral surface. Finally, with the exception of the head, legs and dorsal shields which look dark brown, the general colour of the larva turns yellowish grey (Fig. 4). It is rather elongated and oval in shape with the broadest part at the mesothoracie region. It tapers both to the anterior and to the posterior ends. It is being more so at the latter end. The dorsal surface is distinctly convex, while the ventral surface is slightly so.

The head (Fig. 5) is almost hemispherical in shape with a mouth opening lying slightly ventral. It carries a pair of minute papillate antennae on its latero-dorsal surface just anterior to the ocelli. Each antenna consists of two segments. The distal end of the second segment is provided with a number of sensory pits and setae.

The prothorax is almost trapezoidal in shapĕ, its lateral posterior corners are rounded in their outline. It is slightly more than twice as wide as long. On the dorsal surface there are two quadrate areas, the dorsal shields, which are distinctly darker than the rest of the protergum. These shields cover the greater part of the dorsal surface and almost unite anteriorly but gradually diverge posteriorly.

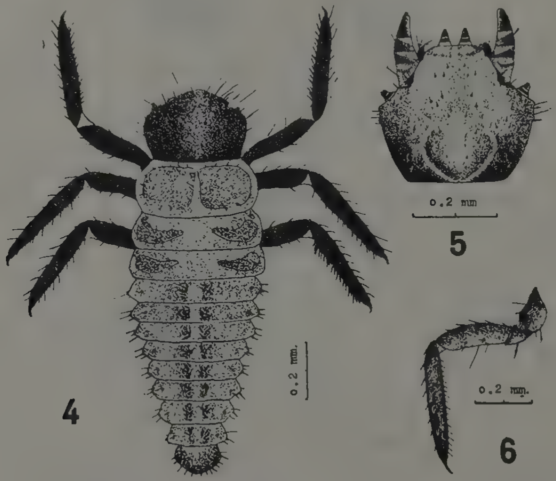


Fig. 4 : First instar larva, dorsal view. — Fig. 5 : Head of first instar larva. — Fig. 6 : Fore leg of first instar larva.

Both the meso- and metathorax are rectangular in shape and are almost equal in size. Each is about four times as wide as long and each carries a triangular dark coloured shield on each side of its dorsal surface. These shields are distinctly smaller than those of the prothorax.

Each thoracic segment carries a pair of legs (Fig. 6) which are similar in shape and are almost equal in size. The tarsus is absent and the tibia ends in a single claw.

The abdomen is spindle shaped. It is broadest at the anterior and gradually tapers posteriorly. The ninth segment is distinct in shape. It is slightly darker than the other segments. Its posterior end is rounded and curves toward the ventral surface and extends a little bit anteriorly. Thus the ventral surface of this segment is reduced. The last abdominal segment is reduced and telescoped within the ninth segment.

The mesothorax and each of the first eight abdominal segments carries a pair of small circular brown coloured spiracles.

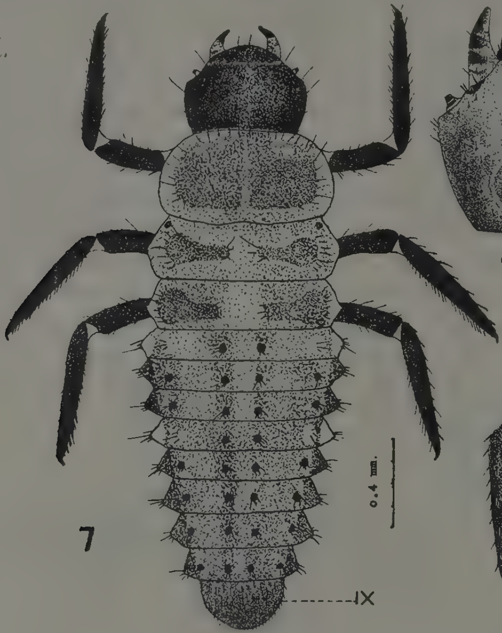
The body is sparsely covered with long hairs which are attached by knob-like bases. Besides, certain regions carry a number of short setae. The thoracic shields are beset with a number of these setae. On the ventral surface of each thoracic segment, there is a pair of tufts of setae located on the sides of the mid-ventral line. The legs are densely covered with similar setae. Each of the first eight abdominal segments carries three pairs of tufts of setae : a dorsal pair, one tuft on each side of the mid-dorsal line, a latero-dorsal pair, one tuft on each latero-dorsal side, and a lateral pair, one tuft on each side. The ninth abdominal segment is densely covered with setae. On the ventral sides of the second to the eighth abdominal segments, there is, in addition, a row composed of six horizontal tufts of setae. On each of the first and the ninth abdominal segments, however, there is a row composed of four tufts of setae only.

Based on measurements taken from fifty larvae about twenty four hours old, the average length of the larva is 1.6 mm., the average width at the widest part is 0.44 mm., and the average width of the head is 0.35 mm.

The second instar larva

The second instar larva (Fig. 7) is similar in shape to the first instar. The widest part, however, is the mesothorax and the first abdominal segment. The general colour of the body is very dark grey or almost black with the exception of few light coloured spots on the lateral surface of the metathorax and on the lateral and the latero-dorsal surfaces of the first and fourth abdominal segments.

The head (Fig. 8) and legs (Fig. 9) are shining black. The dorsal shields of the prothorax cover the greater part of its dorsal surface. They are darker than the rest of the protergum and are separated by a median longitudinal light coloured area. The two pairs of shields on the meso- and metathorax are almost equal in size. They are pear-shaped and again darker than the rest of the meso- and metaterga. Chaetotaxy is almost the same as in the first instar larva. With the exception of the ninth and tenth segments, each abdominal segment bears a pair of dorsal tufts of setae, a pair of latero-dorsal tufts and a pair of lateral tufts. On the ventral surface of each of the second to the eighth segments, there is a row composed of six horizontal tufts of setae. The ninth abdominal segment is densely setaceous. The legs are larger in size and longer than those of the first instar larva.



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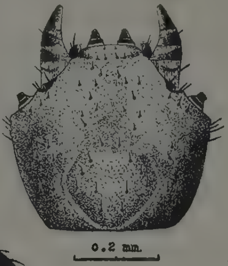

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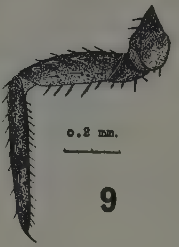

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Fig. 7 : Second instar larva, dorsal view (IX : ninth tergite). — Fig. 8 : Head of second instar larva. — Fig. 9 : Fore leg of second instar larva.

Based on measurements taken for fifty second instar larvae, twenty-four hours old, the average length of the larva is 2.61 mm. and the average width at the widest part is 0.82 mm. The average of the head is 0.4 mm.

The third instar larva

In the third instar larva (Fig. 10) the body is widest at the metathorax and the first three abdominal segments. The general colour is comparatively darker than in the first and second instar larvae, being almost black. The head (Fig. 11) and legs (Fig. 12) are shining black. The prothorax is little wider than long. Its dorsal surface is almost covered with the two shining black dorsal shields. These latter are surrounded by a dark creamy band. The mesothorax is more than twice as wide as long. The two dorsal shields are comparatively larger than in the second instar larva and cover a good part of the dorsal surface. They are black in colour and are separated by a median creamy area. The metathorax is about three times as wide as long.

It is also provided with a pair of pear shaped dark shields which are smaller than those of the mesothorax.

The metathoracic shields are also separated by a large creamy area.

The prothoracic shields carry a number of short setae on their anterior and outer lateral margins. The mesothoracic shields carry a number of such setae on their inner and outer lateral margins. On the ventral surface of the thorax, the arrangement of the setae is the same as in the first and second instar larvae. Arrangement of setae on the abdominal segments does not also differ from that of the first and second instar larvae. The four pairs of creamy spots which appeared at the dorso-lateral sides of the first and fourth abdominal segments, together with the lateral pair on the metathorax, one pair on earch side, of the second instar become remarkably noticeable during this stage.

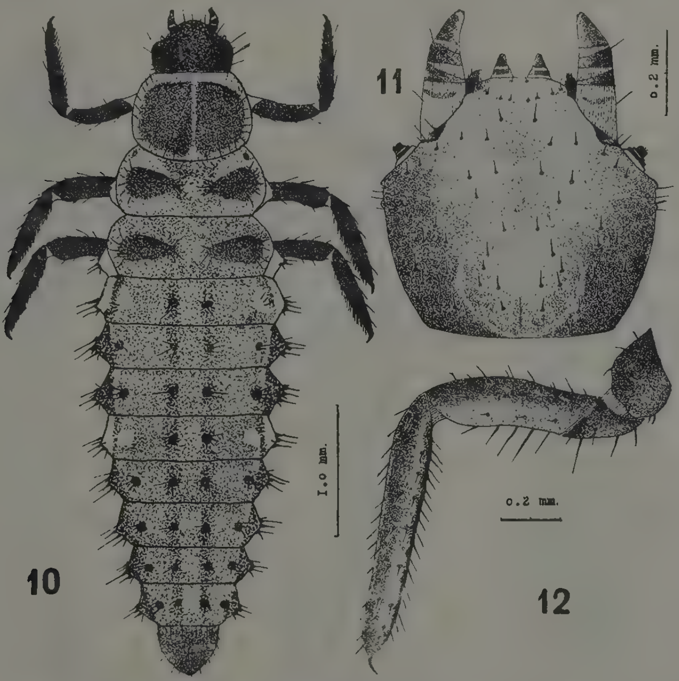


Fig. 10 : Third instar larva, dorsal view. — Fig. 11 : Head of third instar larva. — Fig. 12 : Fore leg of third instar larva.

The average length of this instar larva is 3.9 mm. and the average width at the broadest part is 1.5 mm. while the average width of the head is 0.6 mm.

The fourth instar larva

The general colour of the fourth instar larva (Figs. 13 to 15) is deep grey, almost black, with the exception of few creamy spots and areas which are scattered among the different segments of the body. The areas of the metathorax and of the first and fourth abdominal segments turn, however, yellowish orange. The ventral surface, on the other hand, takes a colour which is lighter on the three thoracic segments than on the rest of the body. The head and legs remain shining black.

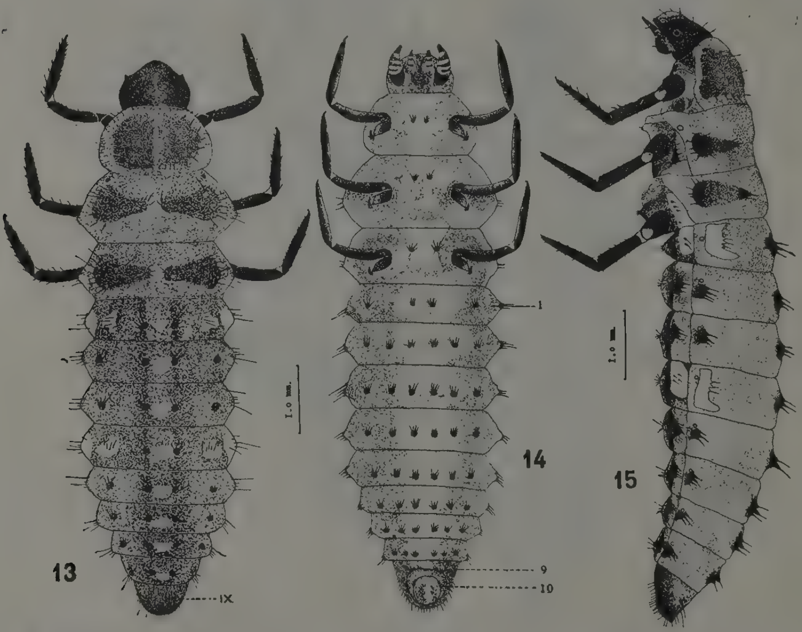


Fig. 13 : Fourth instar larva, dorsal view (IX : tergite). — Fig. 14 : Fourth instar larva, ventral view (1, 9 and 10 : sternites). — Fig. 15 : Fourth instar larva, lateral view.

The body is rather hemispherical in cross-section, the dorsal surface being convex, while the ventral surface being more or less flattened.

The prothorax is slightly wider than long. Its dorsal shields cover the greater part of the tergum. The shields are separated along the mid-dorsal line by a narrow white grey area. Running along the lateral and posterior margins of the dorsal shields of the protohrax is an orange narrow area. The shields are beset with a number of short setae especially along the anterior, posterior and outer lateral margins. Laterally the prothorax is destitute of setae.

The mesothorax is more than twice as wide as long. It also carries a pair of pear shaped shields, one on each side, on its dorsal surface. A median creamy area occurs between the two shields. Each mesothoracic shield has a pair of tufts of hairs, one on its inner and the other on its outer side. Besides, the shields are beset with few scattered setae. The mesothorax carries also a number of short setae along the mid-lateral line. The metathorax is almost similar to the mesothorax. It is, however, a little shorter and wider than the latter. It carries two creamy white spots, one on the latero-posterior surface of each side. The shields and tufts of setae are similar to those of the mesothorax. The ventral surface of each thoracic segment is provided with a pair of small strumae, one on each side of the mid-ventral line. The pleura of the meso- and metathorax are well developed and subequal.

The abdomen is rather cone-shaped and tapers posteriorly. The first and fourth abdominal segments have two pairs of orange spots each. On the side of each of these segments there is one spot on the latero-dorsal surface and another on the lateral surface (Fig. 15). Each of the first eight abdominal segments carries three pairs of strumae, one dorsal, one latero-dorsal, and one lateral. Ventrally, abdominal segments two to eight have three pairs of strumae each. The first abdominal segment, however has only two pairs. The tergum of the ninth abdominal segment (Fig. 16) is shield shaped with a posterior margin rounded in outline. It is dark coloured and bears a large number of setae. The sternum of this segment (Fig. 17) carries two pairs of strumae. The tenth abdominal segment is not visible from the dorsal surface. It appears as a small ring of thin membrane which is telescoped within the ninth segment in the anal region. The anal region is rosette in shape because of the evagination of the rectum which serves as a sucking disk and aids the larva in locomotion. This segment is lighter in colour than the other segments and has a pair of dorsal dark spots on its tergum (Fig. 16). Each dark spot is beset with short setae.

Nine pairs of spiracles are situated on the mesothorax and on each of the first eight abdominal segments (Fig. 15). Each spiracle is located laterally between the dorso-lateral and lateral strumae, slightly dorsal to the mid-lateral line. The mesothoracic spiracle is located between the mesotergum and the mesopleuron.

The legs of the fourth instar larva (Fig. 18) are stout, dark in colour, well developed and long. They are densely covered with setae. The three pairs are almost equal in size and similar in shape. The length of each leg is slightly more than the width of the body at its widest part.

The precoxa is a short triangular plate with few scattered setae. The coxa is short and sub-cylindrical in shape. It is attached to the coxal fossa by the membranous coxacoria (G a g e, 1920). The trochanter is triangular in shape with its ventral surface much larger than the dorsal. Its proximal ends articulates freely with the coxa while its distal end is rigidly fixed to the femur. The latter is the largest segment of the leg while the tibia is the longest one. The tibia is almost cylindrical in shape. Its outer surface is concave, while its inner surface is less deep. This latter surface is more densely fringed with setae. At its distal end, the tibia carries a single minute claw (Fig. 19). The tarsus is entirely wanting. The claw is much lighter in colour than the rest of the leg and is provided with a blunt appendiculate tooth.

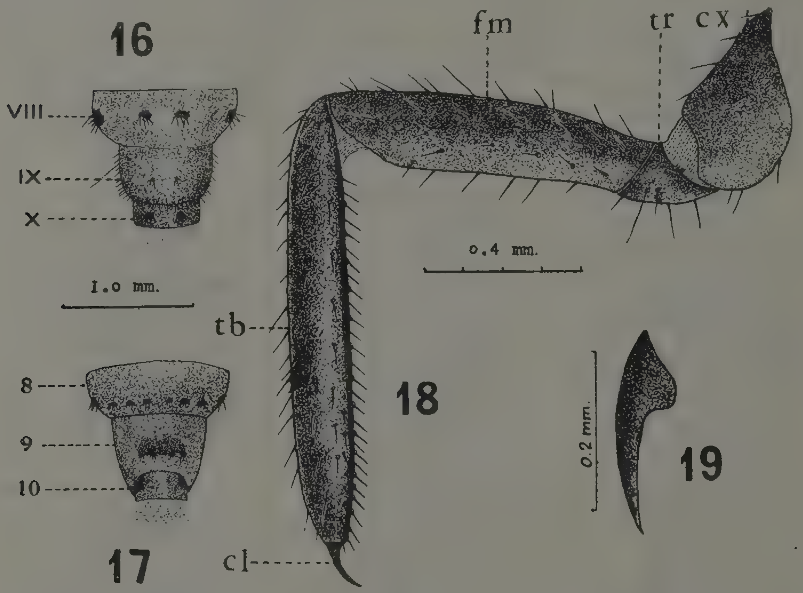


Fig. 16 : Caudal end of fourth instar larva, dorsal view (VIII, IX and X : tergites). — Fig. 17 : Caudal end of fourth instar larva, ventral view (8, 9 and 10 : sternites). — Fig. 18 : Fore leg of fourth instar larva (cf: claw: cx: coxa; fm: femur; tb: tibia; tr: trochanter). — Fig. 19: Claw of the leg of the fourth instar larva (much enlarged).

The average length of the fourth instar larva is 8.1 mm. and the average width at the widest part is 1.9 mm. while the average width of the head is 0.8 mm.

The following Table summarises the average dimensions of the four instar larvae.

LARVAL INSTARS	LENGTH IN MM.	WIDTH IN MM.	WIDTH OF THE HEAD IN MM.
First	1.60	0.44	0.33
Second . . .	2.61	0.82	0.40
Third	3.90	1.50	0.60
Fourth	8.10	1.90	0.80

The head of the fourth instar larva

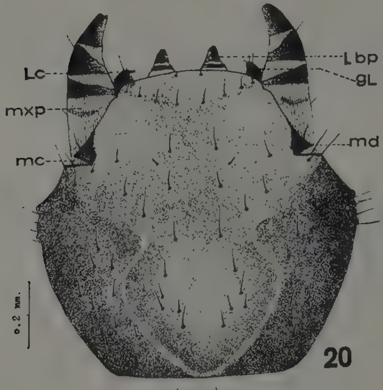
The head structures of the fourth instar larva are almost similar to those of the three previous instar larvae, being only different in size.

The head (Figs. 20-23) is small as compared with the large fleshy body. It is rather hemispherical in shape and is longer than broad being about 0.9 mm. long and 0.8 mm. wide. Its dorsal surface extends a little more posteriorly than its ventral surface. It is strongly scelerotised and in general shining black in colour. Its dorsal surface carries some scattered long setae. On the ventral surface, the setae are found mainly on the labium and maxillae.

The occipital foramen (Fig. 22) is large and somewhat oval. The vertex occupies all of the dorsal and lateral parts of the capsule not included between the epicranial arms (Fig. 21). The vertex extends on the lateral and postero-lateral sides of the head to meet the gena. The latter (Fig. 22) is well developed and forms the greater part of the sides of the head. The two epicranial arms diverge immediately above the occipital foramen and each curves laterally and proceeds forward, then half way along the dorsal side of the head it curves again and extends a short distance latero-ventrally to a point dorsal to the antennal fossa. A portion of the front extends between the arms and the occipital foramen. The front and clypeus are fused and the front-clypeal suture is wanting. Located on each side of the post-clypeus, meso-ventrad to the antennal fossa at the point of origin of the clypeal suture is a knob-like process, the precoila (Gage, 1920) which fits in the preartis of the mandible. The clypeus lies in the cephalic region of the head posterior to the labrum and separated from it by the clypeolabral suture. Viewed dorsally the clypeus is not distinct from the frons.

There are six ocelli arranged in two groups of three ocelli each. Each group is located on one side of the head dorsal to the antennal fossa. The ocelli of each group are arranged in the form of a triangle, and all are equal in size.

On either side of clypeo-frontal area is the antennal sclerite (Figs. 21 and 23). It is in the form of an annular slightly sclerotised sclerite, which surrounds the antennal socket (Fig. 24). The gula (Fig. 22) is a rectangular membranous and glabrous sclerite lying posterior to the submentum. It extends cephalad from the occipital foramen to the points of articulation of the maxillae and submentum with the head. Posteriorly the gula is continuous with the neck membrane and is laterally limited by the extension of the metatentorial arms from the base of the maxillae to the occipital foramen.



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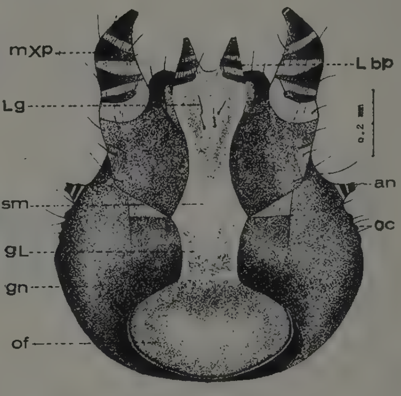

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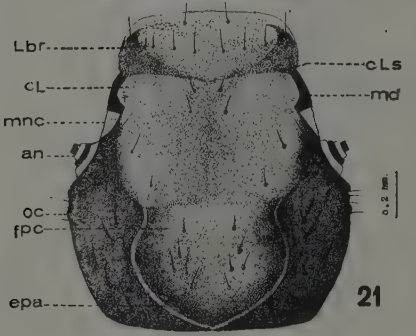

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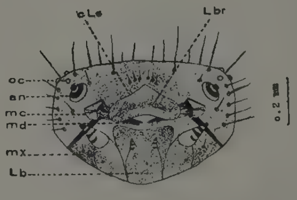

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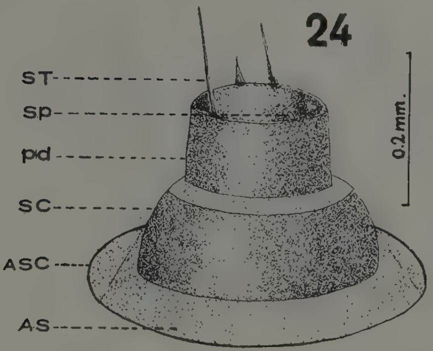
Fig. 20 : Head of fourth instar larva, dorsal view (gl: galea; lc: lacinia; lbp: labial palp; mc: mandacoria; md: mandible; mxp: maxillary palp). — Fig. 21: Head of fourth instar larva, dorsal view (an: antenna); cl: clypeus; cls: clypeolabral suture; epa: epicranial arm; fpc: frons and postclypeus; lbr: labrum; md: mandible; mnc: mandacoria; oc: ocelli). — Fig. 22: Head of fourth instar larva, ventral view (an: antenna; gl :gula; gn: gena; lbp: labial palp; lg: ligula; mxp: maxillary palp; oc: ocelli; of: occipital foramen; sm: submentum). — Fig. 23 : Head of fourth instar larva, frontal view, slightly diagramatical (an: antenna; cls: clypeolabral suture; lb: labium; lbr: labrum; mc: mandacoria; md: mandible; mx: maxilla; oc: ocelli).

The antennae (Fig. 24) are very short, about as long as wide and slightly conical in shape. Apparently it consists of two segments: the basal one which is cylindrical and much wider than long, slightly sclerotised and bearing few fine setae: the distal segment, smaller than the basal one, almost as wide as long, provided with a few long setae on its distal end together with few fine setae and few probably tactile setae and many sensory pits.

The head is connected with the thorax by a narrow flexible neck.



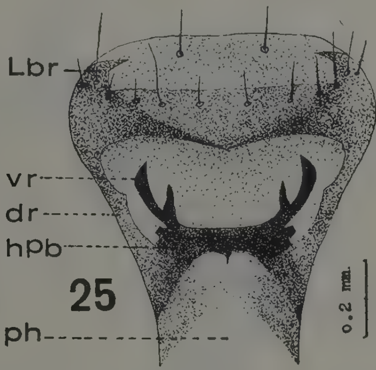
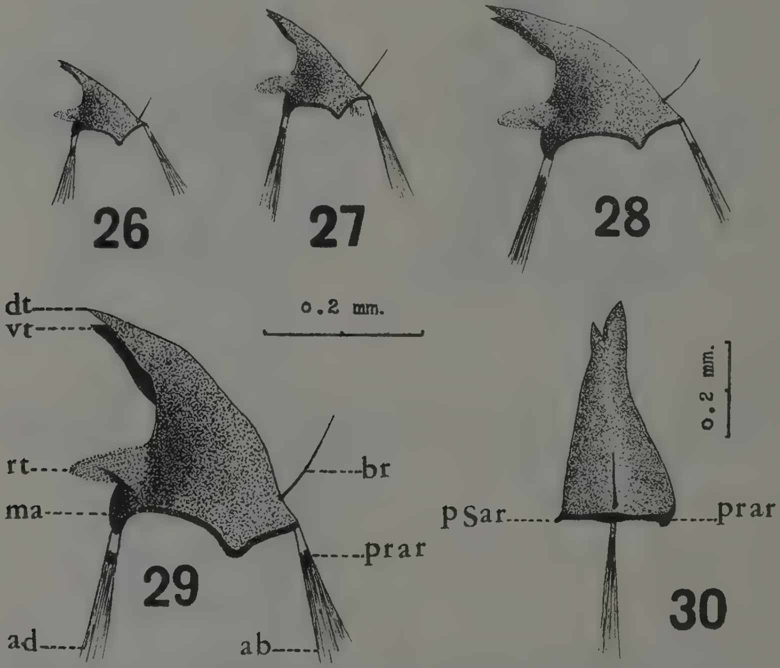


Fig. 24 : Antenna of fourth instar larva (as: antennal socket; asc: antennal sclerite; pd: pedicel; sc: scape; sp: sensory pit; st: seta). — Fig. 25 : Hypopharynx and labrum of fourth instar larva, viewed from inside (dr: dorsal rod; hpb: hypopharyngeal bridge; lbr: labrum; ph: pharynx; vr: ventral rod).

The mouth parts

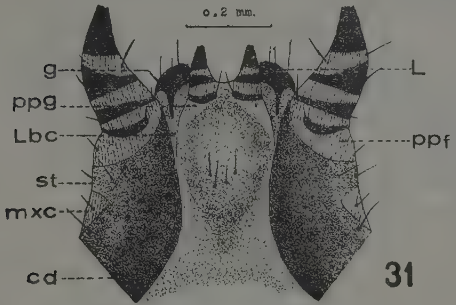
The labrum (Figs. 21, 23 and 25) is transversely elongate. Its posterior part is comparatively much more sclerotised than its anterior part and is connected with the clypeus. Its anterior part is quite membranous and shields the epipharynx which is continuous with the roof of the fore-gut. Posteriorly, the two sides of the epipharynx are attached to the two dorsal rods of the hypopharynx. The distal margin of the labrum is slightly emarginated and bears two medium sized setae, while the posterior sclerotised part bears ten long setae.

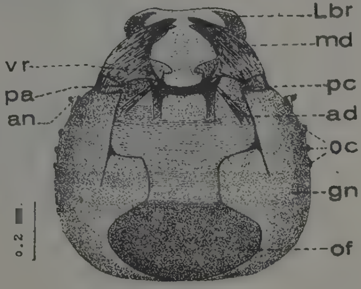
The mandibles (Fig. 29) are well developed. Each mandible is a hollow moderately sized and heavily sclerotised structure having a thick triangular base. It is broad at the base and tapers distally. At its distal end there are two teeth, one dorsal and one ventral (Fig. 30), the former comparatively larger than the latter. The proximo-lateral margin carries a stout bristle-like seta. On the dorso-mesal margin of the base of each mandible there is a protrusion, the preartis, which articulates with the precoila. On the caudomesal margin there is a knob-like structure, the postartis, which fits in the postcoila. Each mandible is connected with the head capsule ventral to the antennal fossa by a small distinct membrane, the mandacoria. The abductor muscles are attached to the lateral margin of the mandible between the preartis and the postartis, while the adductor muscles are attached near the broad molar area. In front of the inner angle of the base of the mandible, there is the broad molar area. Towards the anterior end of this area is inserted the retinaculum (Gage, 1920). The molar bases of the two mandibles are widely separated, and work against the concave sides of the hypopharyngeal bridge between the dorsal and ventral rods of the hypopharynx.



Figs. 26 to 29 : Mandible of first, second, third and fourth instar larva respectively (ab: abductor muscle; ad: adductor muscle; br: bristle; dt. dorsal tooth; ma: molar area; prar: preartis; rt: retinaculum; vt: ventral tooth). — Fig. 30 : Mandible of fourth instar larva, lateral view (prar: preartis; psar: postartis).

The maxilla (Figs. 22, 31, 32 and 33) is comparatively large and slightly sclerotised, and more sclerotised on the ventral than on the dorsal surface. The cardo and stipes are fused, and occur at the proximal end of the maxilla anterior to the gula. The maxilla is about as wide as long, more or less rectangular in shape and slightly setaceous. Its proximal end represents the cardo, while the remaining part represents the stipes. The palpifer is a distinct membranous area which is strengthened by a semi-circular sclerotisation. On the inner end of this semi-circular ring there is a distinct seta. The palpifer bears the three segmented maxillary palp which is well developed and rather stout. The basal segment of the palp is the largest, it is cylindrical in shape, wider than long and usually carries one or two short setae.





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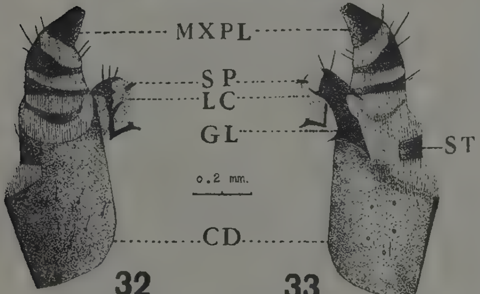

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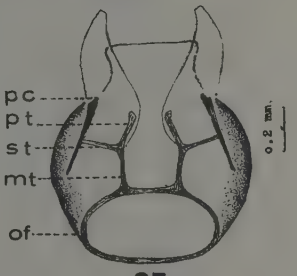

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Fig. 31 : Maxilla and labium of fourth instar larva (cd: cards; g: galea; l: lacinia; lbs: labiacoria; mxc: maxacoria; ppf: palpifer; ppg: palpiger; st: stipes). — Figs. 32 and 33 : Maxilla of fourth instar larva, ventral and dorsal view respectively (cd: cardo; gl: galea; lc: lacinia; mxpl: maxillary palp; sp: spine; st: stipes). — Fig. 34 : Head of fourth instar larva showing the articulation of the mandibles, ventral view (ad: adductor; an: antenna; gn: gena; lbr: labrum; md: mandible; pa: postartis; pc: postcoila; oc: ocelli; of: occipital foramen; vr: ventral rod or arm of hypopharynx). — Fig. 35 : Tentorium of fourth instar larva (mt: metatentorial arm; of: occipital foramen; pt: pretentorial arm; pc: portcoila; st: supratentorial arm).

The intermediate segment is almost as long as wide and carries two or more rather long setae. The distal segment is conical in shape, about one half as long as wide, and bears two or more setae and a group of sensoria at its distal end. The mesal margin of the maxilla and the lateral margin of the labium are connected by a distinct membrane, the labiacoria (Gage, 1920). The lateral margin of the maxillary palp is connected to the postgena by a membrane, the maxacoria (Gage, 1920). The lacinia (Fig. 33) is a broad rounded spongy structure. Its base is more heavily sclerotised. The lacinia is attached to the inner surface of the distal end of the palpifer. Laterally, towards the mouth cavity, each lacinia carries a short, stout and bifurcate spine. Extending along the inner margin of the palpifer, there is an almost rectangular heavily sclerotised plate, probably the galea. Anteriorly this plate carries a pair of comparatively long setae.

The labium (Figs. 22, 23 and 31) is situated anterior to the gula between the two maxillae and forms the floor of the preoral cavity. It is largely membranous and is composed of a proximal submentum and a distal ligula which are not distinctly separated from each other. The submentum carries four setae. There is no distinct mentum. On each side of the ligula there is a rather swollen palpiger. This organ is strengthened at its base by a semicircular sclerotised band which carries a distinct spine towards its inner end. Each palpiger carries a two segmented labial palp. The basal segment of the palp is short and compartively wide, while the distal segment is conical in shape and carries a group of tactile setae at its apex.

The hypopharynx (Figs. 25 and 34) is almost trapezoidal in shape, lying at the floor of the preoral cavity. It extends anteriorly forming a pair of arms on each side, one dorsal and one ventral. The dorsal arms are attached to the lateral sides of the epipharynx to strengthen it. The ventral arms are comparatively highly sclerotized, each having a short branch, and are attached to the floor of the preoral cavity. The hypopharyngeal bridge has a small sclerotized protrusion on each side. The broad molar area of the mandible fits in the groove formed between the protrusion of this bridge and the dorsal arm of the hypopharynx.

The tentorium

The tentorium of the head (Fig. 35) consists of three distinct pairs of arms :

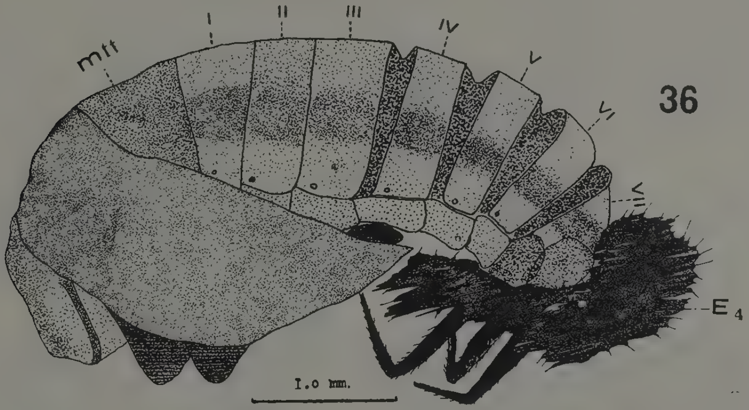
(1) The pretentorial arm is the most anterior arm, originates as an invagination from the dorsal surface of the head near the anterior end of the epicranial arm.

(2) The supratentorial arm which originates as an invagination from a point on the external surface of the head near the antennal fossa.

(3) The metatentorial arm which originates as an invagination from a point near the base of the maxilla and extends posteriorly marking the sides of the gula to the occipital foramen. The two metatentoria diverge laterally to surround the occipital foramen.

The pupa

When the full grown larva is about to pupate it fastens its caudal end


mtt
I
II
III
IV
V
VI
VII
E4
1.0 mm.

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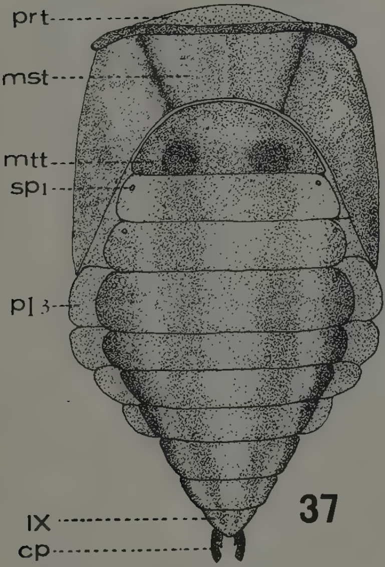
prt
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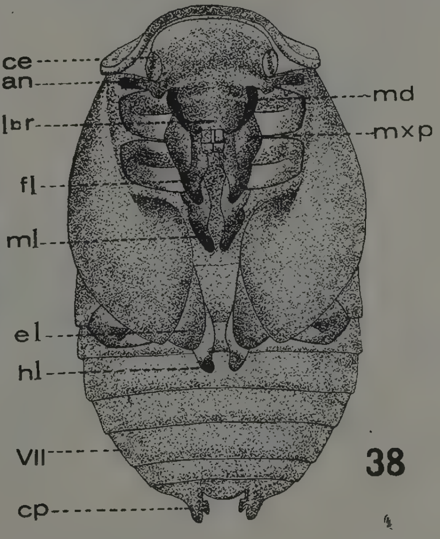
37


ce
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mxp

38

Fig. 36 : The pupa, lateral view (E4: exuvium of fourth instar larva; mtt: metathorax; I to VII: abdominal tergites). — Fig. 37 : The pupa, dorsal view (cp: caudal process; mst: mesothorax; pl 3: pleuron of third abdominal segment; prt: prothorax; sp 1: spiracle of first abdominal segment; IX: ninth abdominal segment). — Fig. 38: The pupa, ventral view (an: antenna; ce: compound eye; cp: candal process; el: elytron; fl: fore leg; hl: hind leg; lbr: labrum: md: mandible; ml: middle leg; mxp: maxillary palp; VII: seventh abdominal segment).

to a leaf, stem or any other substratum. The larval skin is pushed backward at the posterior end of the abdomen and the pupa appears (Fig. 36).

The pupa (Figs. 37 and 38) is convex with an average length of 4.8 mm. and an average width of 3.2 mm The newly formed pupa is yellow in colour. dotted, however, with a number of creamy spots which are arranged in longitudinal rows on its dorsal surface. Few hours later the pupa changes its colour to deep grey with faint suggestions of orange and creamy spots on the dorsal and lateral sides, and afterwards undergoes very little changes in colour until few days before emergence of the adult when it becomes much darker. The skin which protects the pupa is much more sclerotised on the dorsal and lateral sides than on the ventral, the latter side being in the form of thin, more flexible membrane. The external surface of the pupa is covered with very short black hairs which appear whitish due to light reflections.

The head of the pupa (Fig. 38) lies under the prothorax and therefore cannot be seen from the dorsal surface. The mouth parts are situated ventral to the prosternum. The labrum (Fig. 39) takes the form of a solerotised rectangular plate which covers the other mouth parts with the exception of the labial and maxillary palpi. Each mandible (Fig. 40) is almost triangular in shape with a sharp apex. The maxillae and labium (Figs. 41 and 42) are not yet completely differentiated into the normal parts which will be found later in the adult. The labial palpi are blunt and their segmentation is not visible. The maxillary palpi (Fig. 42) are funnel-shaped, comparatively large and do not also show any visible segmentation. The antennae (Fig. 43) lying on the sides of the head appear unsegmented.

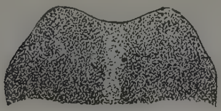
The protergum is comparatively large. The mesotergum is almost trapezoidal in shape and lies between the two basis of the elytrae. The metatergum is rather semi-circular in shape with two dark areas near its posterior margin.

The three thoracic sternites are membranous. The prosternum is ventrally covered by the hind- and fore-legs. The elytrae are convex, each is rather triangular in shape and extends posteriorly to the fifth abdominal segment.

Each leg (Fig. 44) seems to consist of four distinct cylindrical slightly sclerotized segments which may correspond to the coxa, femur, tibia and tarsus. The tarsus is not divided into the subsegments which are formed in the adult.

The abdomen is rather spindle in shape and tapers posteriorly. It consists of nine visible segments, the third abdominal segment being the broadest. The abdominal terga seem to be more sclerotised than the abdominal sterna, the latter being in the form of thin membrane.

The last abdominal segment is triangular in shape and carries a pair of comparatively long slightly sclerotised caudal processes which lie in a pair of cavities at the posterior end of the fourth instar larval skin. These processes seem to serve as a mean of attaching the pupa to the last larval skin and therefore help in keeping it attached to the substratum to which this skin is fixed. The pleura of the first six abdominal segments are visible on both sides. They are in the form of well sclerotised quadrate plates (Fig. 36).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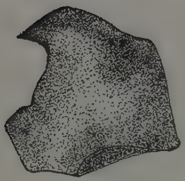
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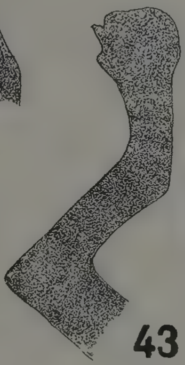
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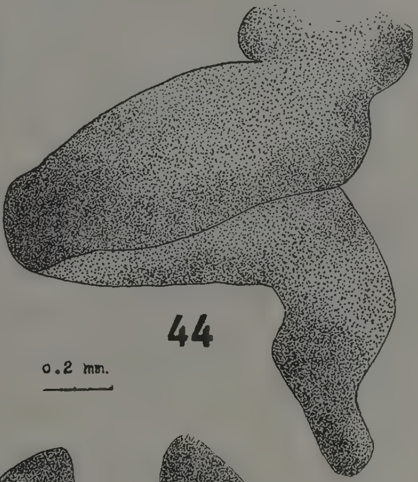

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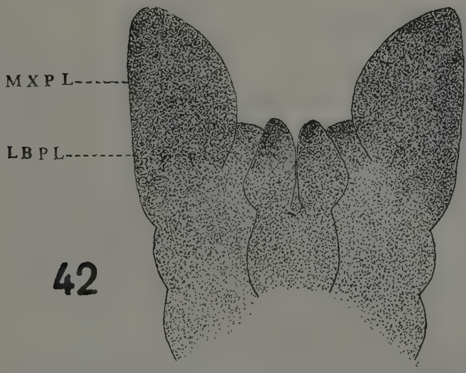

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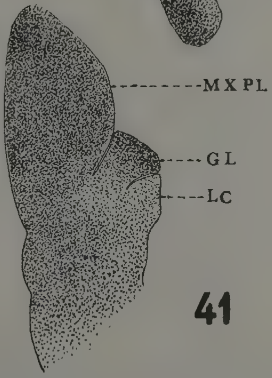

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Fig. 39 : Labrum of pupa. — Fig. 40 : Mandible of pupa. — Fig. 41 : Maxilla of pupa (gl: galea; lc: lacinia; mxpl: maxillary palp). — Fig. 42: Labium and maxillae of pupa (lbpl: labial palp; mxpl: maxillary palp). — Fig. 43: Antenna of pupa. — Fig. 44: Leg of pupa.

The abdomen carries six pairs of visible spiracles, one pair on each of the first six abdominal segments. The spiracles are located at the anterior corners of each segment on its laterodorsal surface, one on each side.

SUMMARY

Coccinella undecimpunctata L. is a cosmopolitan Coccinellid beetle which, in Egypt, is represented by the race *aegyptiaca* Reiche. It is very common all over the country, both in the Nile Valley and the desert. Unfortunately very little was known on the behaviour of this predator in Egypt and in other countries. In an earlier work the writer (1948) dealt with the morphology and anatomy of the adult insect. The present paper comprises some preliminary notes and the morphology of the early stages.

The synomy of *Coccinella undecimpunctata* L. and its race *aegyptiaca* Reiche are recorded. It is rather a carnivorous insect already recorded as feeding on the eggs and the larval stages of eleven species of insects hosts, mostly aphids.

The breeding method in the laboratory is described.

The morphology of the early forms is given. The egg is spindle in shape and orange yellow in colour. It averages about 0.88 mm. in length and about 0.40 mm. in width.

The four instar larvae are described. Their dimensions are recorded. Arrangements of hairs and tufts of setae are given in detail. In the leg, the tarsus is absent. The head of the fourth instar larva is described in detail with special reference to the mouth-parts and the tentorium.

The pupa and the pupal skin, the different parts and the appendages of the head, as well as the thorax and abdomen, are described.

ACKNOWLEDGMENT

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Calliphoridae of medical interest in the Sudan

[Diptera]

(with 6 Text-Figures)

by D.J. Lewis, M.A., Sc.D.,
Entomologist, Sudan Ministry of Health

CONTENTS

Introduction. — Classification. — Sarcophaginae. — Calliphorinae : Rhiniini, Chrysomyiini, Calliphorini. — Distribution. — Flies which breed in carrion. — Myiasis — Attraction to malodorous plants. — Summary. — Acknowledgments. — References.

INTRODUCTION

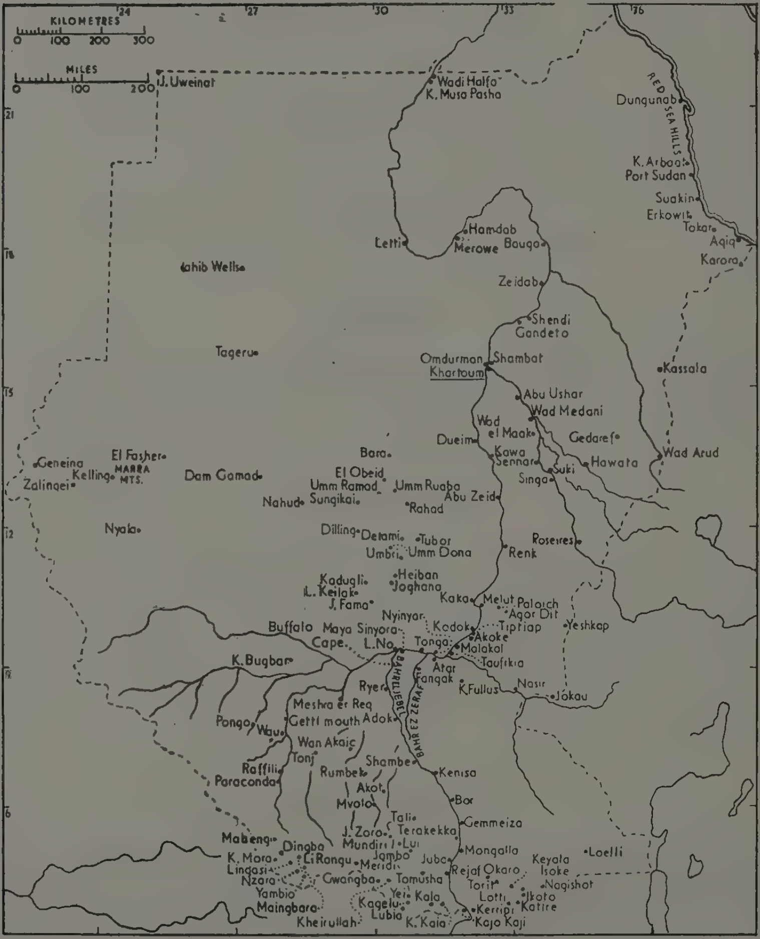
A few of the species mentioned in this paper are pests of some importance. The others come to the attention of a medical entomologist mainly because they breed in or settle on refuse or breed in wounds, or because they resemble species which do so. Some species are harmless and a few may be beneficial.

In the locality lists « J » indicates a Jebel or hill and « K » a Khor or watercourse.

CLASSIFICATION

The following are some papers dealing with the classification of *Calliphoridae :* the whole family, White and others (1940) ; *Wohlfahrtia,* Salem (1938) and Ségny (1941) ; *Sarcophaga,* Zumpt (1950) ; Rhiniini, Peris (1952) ; *Chrysomyia,* Curran (1928), Holdaway (1933), and Patton and Cushing (1934) ; Calliphorini, Malloch (1929 a) ; *Lucilia,* Aubertin (1933) ; Curran (1928), Malloch (1926), and Patton and Cushing (1934) ; *Auchmeromyia,* Patton (1935) ; *Bengalia,* Malloch (1927).

In the identification of species of *Lucilia* and *Chrysomyia* it should be remembered that the colouring can vary within a single species and that an individual specimen can change colour when it becomes dry. According to Aubertin (1933) the body colour of a species of *Lucilia* is extremely variable and moistening can make dead purple specimens appear green.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MILES
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6
J. Uweinat
Wadi Halfa
K. Musa Pasha
RED SEA HILLS
Dungunab
K. Arboat
Port Sudan
Suakin
Erkowit
Tokar
Aqiq
Karora
Hamdab
Merowe
Letti
Bauga
Lahib Wells
Zeidab
Shendi
Gandeto
Tageru
Omdurman
Shambat
Khartoum
Kassala
Abu Ushar
Wad Medani
Wad el Maak
Gedaref
Dueim
Kawa
Sennar
Suki
Hawata
Wad Arud
Singa
Geneina
El Fasher
MARRA MTS.
Kelling
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Dam Gamad
Bara
El Obeid
Umm Ramad
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Abu Zeid
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Nyala
Dilling
Delami
Tubor
Umbri
Umm Dona
Roseires
Renk
Kadugli
Keilak
Heiban
Joghana
J. Fama
Kaka
Melut
Paloich
Agor Dit
Nyinyor
Kodok
Tiptiap
Yeshkap
Buffalo Cape
Maya Sinyora
L. No
Tonga
Akoke
Malakal
Taufikia
K. Bugbar
Atar
Fangak
BAHR EL JEBEL
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K. Fullus
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Wan Akaic
Tonj
Shambe
Raffili
Paraconda
Rumbek
Kenisa
Akot
Mvolo
Bor
Tali
J. Zoro
Terakekka
Gemmeiza
Mabeng
Dingba
Mundiri
Lui
Mongalla
Keyala
Loelli
K. Mara
Li Rangu
Jambo
Meridi
Juba
Isoke
Lingasi
Nzara
Gwangba
Tomusha
Rejaf
Okaro
Torit
Nagishot
Yambio
Yei
Kala
Lotti
Ikoto
Maingbara
Kagelu
Kerripi
Katire
Kheirullah
Lubia
K. Kaia
Kajo Kaji

Fig. 1: The Sudan showing places mentioned in the text.

In the larva some variation of the width of the peritreme of the posterior spiracles can occur within certain species of *Chrysomyia* (Patton and Cushing, 1934).

Some flies which breed in decaying material can vary greatly in size, probably owing to limitations of the larval food supply which is known to causes such variations in *Musca sorbens* Wiedemann. Examples are *Wohlfahrtia nuba* and *Sarcophaga tibialis* of which details are given below.

SARCOPHAGINAE

Wohlfahrtia

According to Patton (1938) there are 16 or 17 species in this genus and most of them occur in the Palaearctic Region. Zumpt (1951) states that the notorious myiasis-producing *W. magnifica* Schiner of north Africa is replaced by *W. nuba* in southern Egypt, Somaliland and various parts of the Sudan. Species of *Wohlfahrtia* occur mainly in the northern Sudan and are among the few insects which have been brought back by explorers from the north-west desert where Shaw (1933) suggests that they may be transported from place to place by camels.

Wohlfahrtia brunnipalpis Wiedemann. — This species is recorded from Aden, Egypt, the Gambia and the Sudan (Salem, 1938), but the Sudan locality is not exactly known.

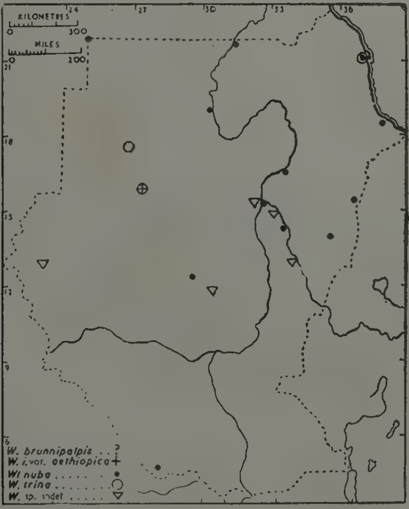


Fig. 2 : The known distribution of *Wohlfahrtia brunnipalpis, W. indigens* var. *aethiopica, W. nuba, W. trina* and *W.* sp. in the Sudan.

Wohlfahrtia indigens var. *aethiopica* Villeneuve. — This is a Somaliland variety of a species which is common in Egypt (Salem, 1938). In the Sudan it is known from Tageru (W.B.).

Wohlfahrtia nuba (Wied.). — The early stages of this species have been described by Lari (1952). He remarks that it is an Ethiopian species, described in 1830 from Nubian specimens, which has spread to the desert regions of Pakistan, probably by breeding in nomadic people, camels or locusts in the intervening areas. In the Sudan it is known from Dongola, Dungunab (H.B.J.), Gedaref, Kassala (A.A.B.), Khartoum (Longstaff, 1911), Li Rangu, Shendi, the Sungikai area (Becker, 1923), « the Sudan » (Grantham-Hill, 1923; Salem, 1938), Tokar, J. Uweinat (Shaw, 1933), Wadi Halfa and Wad Medani, and has been found near J. Uweinat but outside the Sudan at Tekro Oasis (19° 30' N., 20° 54' E.) and north-west of it (Shaw, 1933). An allied species, possibly *W. triquetra* Ség., has been found outside the Sudan at 19° 40' N., 20° 42' E. by the Bagnold Expedition of 1932. *Wohlfartia* sp., probably *W. nuba*, has been found at Abu Usher, Delami, Omdurman, Singa and Zalingei.

W. nuba has been bred from the dead bodies of fowl, goat, guinea-pig, rat and a snake (Wad Medani, W.H.G.). Grantham-Hill (1933) obtained maggots from human wounds from various parts of the country and from camels, and reported that they were *W. nuba*. The following additional records of this species are based on specimens received for identification from cases of myiasis in man and domestic animals. In 11 human cases larvae were found in the back, ear (W.F.T.C.), foot, hand (after a snake bite), leg and other parts of the body. The infected ear was that of a three-year-old boy who felt pain for several hours after which there was a discharge of blood which did not relieve the pain. The infected animals were a camel, a donkey, a horse (at Wad Medani), a rabbit (at Wad Medani, ulceration of the submandibular region) and a sheep (at Wad Medani, ulceration of the mucous membrane of the mouth and skin near the mouth).

Grantham-Hill (1933) reported that the larvae encouraged healing, but that if too many were placed in a wound they would destroy some living tissue at the edges. Stewart (1934) considered that larvae of *W. nuba* were potentially dangerous to healthy tissue. Bedford (1933) reported the use of this species for « maggot therapy » in the Sudan before this method of treating wounds was superseded. He found that if young larvae were placed in a wound they emerged to pupate 48 hours afterwards.

Lari (1952) gives two records of *W. nuba* larvae from living Orthoptera. Labels in the Sudan Ministry of Agriculture collection show that some specimens were bred from living insect larva on lucerne and from a Sudan

Boll Worm (*Diparopsis castanea* Hamps., Lepidoptera) at Shendi, and a living desert locust (*Schistocerca gregaria* Forsk.) at Tokar.

The chalcid, *Dirhinus wohlfahrtiae* Ferrière (1935), has been bred from pupae at Khartoum.

Wohlfahrtia trina (Wied.). — This species, which occurs in Europe and north Africa (Salem, 1938), is known in the Sudan from Dungunab, Rahib Wells (Z.K.M.T.) and Tageru (W.B.).

Sarcophaga

Most species of this genus breed in decaying material and some can parasitize insects. Thirteen species occur in the Sudan where several of them are widely distributed. *S. barbata* Thomson, which (Dr. F.I. Van Emden informs me) is a widely distributed species more Palaearctic than Ethiopian, has been found in a small collection from Jeddah (A.A.B.) but not in the Sudan. It is common indoors in England (Woodroffe, 1953).

Of the *Sarcophaga* whose breeding habits are known in the Sudan, four can breed in human faeces, three in carrion, and three in rotting fruit. Some have a considerable range of breeding places.

A chalcid hymenopteron, *Brachymeria* sp., has been bred from pupae of *Sarcophaga* collected as larvae in human faeces at Merowe.

Sarcophaga tuberosa aegyptiaca Salem has been recorded from Wadi Halfa.

Sarcophaga tuberosa exuberans Pandellé is an almost cosmopolitan species (Cuthbertson, 1937) which in the Sudan is known from Dongola, J. Haina (R.C.M.-D.), Kagelu (J.G.M.), Khartoum (Rohdendorf, 1931), Meridi, Rejaf area (Rohdendorf, 1931), Tokar, Wadi Halfa, Yei and Zeidab (Rohdendorf, 1931). It has been bred from human faeces at Khartoum and from dead rats.

Sarcophaga globicauda Rohdendorf is known from Mongalla (Rohdendorf, 1931) and Wad Medani (bred from a dead guinea-pig).

Sarcophaga haemorrhoidalis Fallen is widely distributed in the Palaearctic and Nearctic Regions and extends into the Ethiopian and Oriental Regions (White and others, 1940). It apparently occurs over the greater part of Africa (Curran, 1934). In the Sudan it is known from Kadugli (K.A.A.H.), Karora (Rohdendorf, 1931), Katire, Khartoum, Li Rangu, Mvolo, Nyinyar, Renk, Singa, Tonga (Becker, 1923), Wad Medani and Wau. It has been bred from human faeces and a rotting melon, and adults have been caught in a trap baited with rotting cotton seed.

Sarcophaga hirtipes Wied. occurs in north and west Africa, Asia Minor, Iraq and parts of India (White and others, 1940). In the Sudan it is known from the Bara-El Obeid area and Joghana (Becker, 1923), Delami, Hamdab, Karora (Rohdendorf, 1931), Merowe, K. Musa Pasha, Mvolo, the Sungikai area (Becker, 1923), Pongo, Port Sudan and the Rejaf area (Rohdendorf, 1931), Singa, Tokar, Tonga, Umm Ramad (Becker, 1923), Wadi Halfa, Wad Medani and Wau. Hafez (1940) found that this was the second commonest species in Egypt, that it was the only common one breeding extensively in dung, especially that of the horse, and that it would deposit larvae in carrion and human excreta. In the Sudan it has been bred from human faeces (with *S. haemorrhoidalis* and *S. inaequalis*) and a dead crocodile, and adults have been caught in a trap baited with rotting cotton seed.

Sarcophaga inaequalis Austen is known from Adok, Bor, Delami, Karora (Rohdendorf, 1931), Khartoum, Li Rangu, Nagishot, Sennar, Singa, Tokar, Wad Medani and Wau. It has been bred from human faeces, and adults are attracted to traps baited with cotton seed.

Sarcophaga tibialis Macquart, of which *S. beckeri* Villen. is a synonym, varies considerably in size. The wing of a specimen bred from a dead crocodile was 9.2 mm. long, and that of a fly bred from a dead bat 5 mm. long. The former insect was about six times the volume of the latter. This species occurs at Hamdab, Karora, Loelli, Mvolo, Port Sudan, Suakin, Tokar, Wadi Halfa, Wad Medani and Wau. It has been bred from the dead bodies of a bat, a bivalve mollusc, a crocodile, a crow, fish (at Suakin) and guinea-pigs, and adults have been caught in traps baited with cotton seed.

An undescribed *Sarcophaga*, probably a subspecies of *S. nodosa* Engel, has been found at Khartoum, Singa and Wad Medani, and has been bred from dead guinea-pigs.

An undescribed species has been found at J. Dud and one at Maingbara, and a species, probably allied to *S. fuscadorsalis* Rohd., at Nagishot. A species which may be *S. inzi* Curran occurs at Mvolo.

Sarcophaga (Boetcherella) setinervis Rondani has been bred from a rotten melon at Wad Medani, and found in an aircraft from Asmara at Khartoum (Whitfield, 1939).

Sarcophaga (Phytosarcophaga) destructor Malloch is known from K. Arbaat, Bauga (Rohdendorf, 1930, who reported this species being bred from melons on five occasions), Kassala (Malloch, 1929 a), Khartoum (Malloch, 1929 a; Rohdendorf, 1930), Letti, Tokar, Wad Medani and Zeidab (Rohdendorf, 1931). *S. destructor* breeds in ripe and over-ripe egg-plants, melons and tomatoes in the Sudan, sometimes causing considerable damage, and will deposit larvae in injured locusts, the larvae being able to complete their development in the Desert Locust (Wood, 1933). Another species is reported to attack locusts in the Argentine (Van Emden, 1950).

CALLIPHORINAE

Rhiniini

Many members of this tribe are metallic green or blue species. They can be confused with calliphorines of medical importance but are distinguishable by the characters mentioned by Smart (1948, p. 75).

Bohart and Gressitt (1951) found a species of *Stomorhina* on carrion. *S. lunata* (Fabr.). which is widely distributed in Europe and Africa. is known from Lotti and from Tokar (Peris, 1952).

Rhinia apicalis (Wied.) occurs in Africa, the Orient and the Pacific islands and is attracted by carrion, according to Bohart and Gressitt (1951). Peris (1952) reports *R. cribrata* Big. from near Wad Medani, *R. rugosa* Big. from Kelling and *R. scotti* Stein from the Sudan. *R. apicalis* has been reported from Bara, Erkowit, Loka, Renk and near Tokar (H.H.K.).

Cosmina prasina (Brauer and Von Bergenstamm), a metallic-green fly, occurs at Dam Gamad, Dungunab, Khartoum, Nyala, Shendi, Talodi (Peris, 1952), Wad el Magdub and Wad Medani. A female of this species, on being caught, extruded one large egg from which a larva more than two millimetres long hatched within 24 hours. *C. aenea* (Fabricius) is known from Isoke, Khartoum, Port Sudan, Shambat, Shendi, the « Sudan » (Peris, 1952) and Tokar.

Peris (1952) records *Thelychaeta connivens* Villen. from western Darfur and Nagishot, *T. tristis* Bigot from Wad Medani, *T. fasciculata* Villen. and *T. longicauda* Villen. from Lotti. *T. dubiosa* Villen., which resembles species of *Cosmina*, is known from Kala and Loka.

Chrysomyiini

In most of the inhabited parts of the Sudan there are only three species of *Chrysomyia*, *C. marginalis* with its conspicuous dark costal wing markings, and the clear-winged *C. albiceps* and *C. putoria*. The two last-named have different habits from each other but the adults are very similar in appearance. They can be distinguished by examining the propleural bristle which, with other characters, is discussed below. Of the other Sudan species *C. bezziana* is probably a visitor and *C. chloropyga* and *C. inclinata* are only found in the far south.

Chrysomyia albiceps and *C. putoria* each share several characteristics with the Oriental *C. rufifacies* Macquart and *C. megacephala* Fabr. respectively. For instance the tuberculate larvae of *C. albiceps*, and of *C. rufifacies* (Bohart and Gressitt, 1951) are found in carrion and are largely carnivorous. As in *C. putoria*, the larvae of *C. megacephala* can hang from the surface of liquids suspended by the rim of the spiracular pit (Reid, 1953), and the adults tend to assemble in clusters (Bohart and Gressitt, 1951).

Chrysomyia albiceps Wied. — Holdaway (1933) gives the following characters for this species in distinguishing it from *C. putoria* Wied.: 4-6 propleural bristles; no stigmatal bristle but occasionally a very small seta in this region; abdominal bands narrow. In the Sudan the conspicuous character of the absence of a stigmatal bristle is unreliable since some specimens (the only one seen at Loelli, 2 out of 3 from Shendi, 2 out of 26 from Wad Medani, and 2 out of 25 from Yei) have a stigmatal bristle, in one instance on one side only. The propleural bristles, which may number up to seven, give a reliable character but often can only be clearly seen if the head is removed. Dr. Van Emden informs me that *C. albiceps* also differs from *C. putoria* in the female by the absence of small outwardly-curved anterior orbital setae, and in both sexes by the absence of white pruinosity on the thorax. In doubtful cases the male terminalia (which are illustrated by Holdaway, 1933) may be examined. The colour of bred specimens can vary from bronze to purple in a single locality. The larva has numerous hair-like fleshy processes (Patton and Evans, 1929).

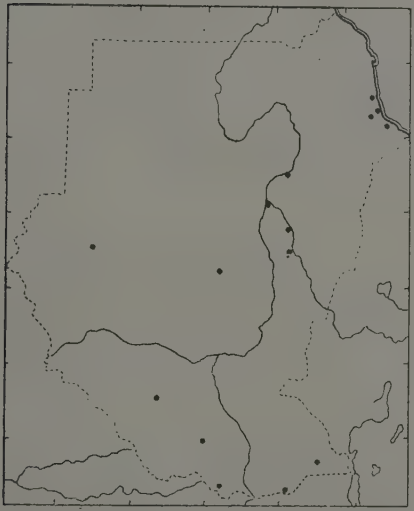
According to Holdaway (1933) *C. albiceps* is mainly Palaearctic and occurs in South Africa, being replaced in tropical Africa by *C. putoria*. Séguy's (1928) map shows *C. albiceps* as far north as Paris. In the Sudan it is known from Erkowit, El Fasher, Gandeto, Khartoum (Patton and Cushing, 1934; Patton and Evans, 1929), Ikoto (M.S.), Loelli (C.J.L.), Mvolo, Rahad (F.G.C.P.), Port Sudan, Sennar, Shendi, Suakin, Tokar, Wau, Yei and Wad Medani. The species has evidenly penetrated far into the Ethiopian Region, and it would probably be shown to have a wider distribution in the Sudan if more flies were bred from carrion.

The larvae of *C. albiceps* were at one time believed to feed only on fly larvae of other species or of their own (Patton and Evans, 1929), but we now know that *C. albiceps* larvae are not obligatory predators (Zumpt, 1951, quoting Smit). Buxton (1923 a) found that in Palestine larvae of *C. albiceps* could be reared to full size without being fed on other larvae. Cuthbertson (1933) reported that this species lays its eggs in batches of 100 to 200 among other blow-fly eggs on carcases, and that the first and second stage *C. albiceps* larvae feed on exudates from the decomposing flesh. He states that the third stage larvae suck other fly larvae when these have eaten into the carcase, or, in their absence, feed on dermestid beetle larvae or on each other.

According to Hepburn (1943 ab) *C. albiceps* is attracted to meat in the later stages of decomposition.

In the Sudan this species has been bred from the dead bodies of cow, crow, fish, goat, guinea-pig and rat. The adults are generally less common than *C. putoria* in fly traps.

Chrysomyia bezziana Villen. — This species has only once been seen in the Sudan when adults were bred from larvae found by Mr. J.K. Thomson on October 14th, 1939, at Wad Medani in two mules which had previously spent several months at Sennar. One mule was in a serious condition. This fly, a notorious cause of myiasis in some parts of Africa, could scarcely escape notice if it existed permanently in the Sudan. At Sennar there is a mule trade with Ethiopia and it seems likely that *C. bezziana* was introduced from that country but failed to establish itself permanently.



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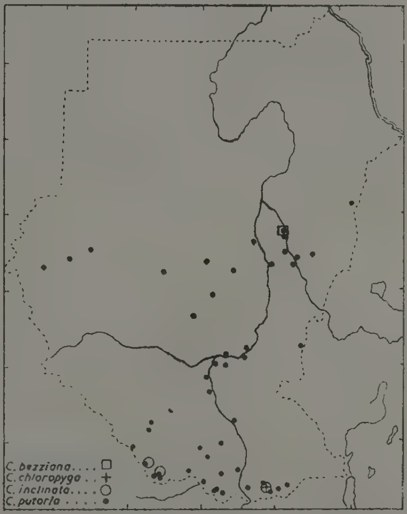

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Fig. 3 : The known distribution of *Chrysomyia albiceps* in the Sudan. — Fig. 4 : The known distribution of *Chrysomyia bezziana, C. chloropyga, C. inclinata* and *C. putoria* in the Sudan.

Chrysomyia chloropyga Wied. — This species has been found at Nagishot.

Chrysomyia inclinata Walker. — This species is known from Li Rangu, K. Mora and Nagishot.

Chrysomyia putoria Wied. — Holdaway (1933) gives the following characters for distinguishing this species from *C. albiceps :* one propleural bristle the same size as the stigmatal bristle, and occasionally a much smaller one; a single very stout stigmatal bristle; abdominal bands occupying approximately one third of lengths of segments. In one Sudan specimen there were two propleurals on one side and four on the other, and occasional specimens have a small third propleural bristle. The colour varies from bronze to purple. The larva lacks the fleshy processes seen in *C. albiceps.*

According to Holdaway *C. putoria* is mainly Ethiopian. In the Sudan it is known from Abu Zeid, Adok, Bahr el Jebel km. 500, Buffalo Cape, Delami, Dueim, Fangak, El Fasher, Gwangba (J.G.M.), Hawata, Isoke (M.S.), Juba, Kadugli (K.A.A.H.). Kagelu, Kala, Kassala, Katire, Kerripi, Kodok, Lingasi, Li Rangu, Mabengi, Malakal, Marra Mts., Meridi, Mundiri, Mvolo, Nagishot, Nahud, S. of L. No, El Obeid, Paraconda, Raffile, Ryer, Sennar, Singa, « the Sudan » (Balfour, 1906), Suki, Tali, Tomusha, Tonga, Tonj, Torit, Umm Ruaba, Wad el Maak, Wad Medani, Yambio, Yei, Yeshkap and Zalingei. *C. putoria* has been sought in vain at Atbara, Dongola, Merowe and Wadi Halfa. It has been found in an aeroplane at Khartoum. None was seen in Omdurman during a survey in 1940, but a few larvae, probably of this species, were found there in 1953. Its numbers have been greatly increased, and its distribution probably extended, by the use of pit latrines, but conditions seem to be rather unfavourable to it along the Nile north of Wad Medani.

C. putoria is very common in the Sudd region where it is presumed to breed in faeces among the shady vegetation fringing the swamps. Hundreds come on board steamers at landing stages such as Adok and Ryer and remain on steamers for days unless they are killed. *C. putoria* has been reported to be common at Wad Medani in the rains, at Singa in April, and at Umm Ruaba in May.

This species breeds very commonly in pit latrines, often in vast numbers. It has been bred from the stale contents of latrine buckets at Wad Medani but has not been found in isolated deposits of human faeces. Cuthbertson (1933) bred this species from rotting meat in Southern Rhodesia. Larvae have seldom been found in this medium in the Sudan and most of the adults bred from them were a typical, being blue and rather small. As far as is known the main breeding places of *C. putoria* in the Sudan are unnatural, namely pit latrines.

Unike the house-fly, *C. putoria* is not hindered from breeding in pit latrines by depth and darkness. The larvae are often found in semi-liquid material, particularly where it is shallow near the edge of a pit. In liquid contents they are to be seen crawling on millet stalks or other floating objects which have been used for cleaning by people visiting the latrine. The larva is not easily drowned. The Oriental species, *C. megacephala,* avoids drowning by closing its posterior spiracular fossa, according to Patton

(1931, p. 625). *C. putoria* does close this fossa from time to time but survives in liquids in a different way. If a larva is placed for a few minutes in a wet tube (or if its breeding medium is flooded for a short time) and is then placed in a beaker of tap water, it floats easily owing to a bubble of gas (apparently air which it has swallowed) in its oesophageal diverticulum. The posterior spiracles remain in contact with the atmosphere owing to their hydrofugal nature, and the larva swims slowly at the surface by wriggling. It can behave as an aquatic animal and remain alive for three days before it sinks and drowns. On the other hand, if a larva is taken straight from a rather dry medium and placed in water it has no time to swallow air and can only float for a short time suspended by its posterior spiracles but with it smouth beneath the surface. If any slight movement dislondges the larva it sinks rapidly and soon drowns. Larvae can remain alive in liquid faecal material for a time but not so long as in water. In one collection of 165 larvae from the liquid contents of a pit latrine only nine were alive. In practice however, larvae can usually swim to some semi-solid material.

The adult flies are often unnoticed even if there are many larvae in latrines. It appears that the flies usually remain in or near the pits but spread among the neighbouring houses when breeding is very active. For instance *C. putoria* is normally present and inconspicuous at Wad Medani but swarms appeared in 1941 when large trench latrines were made for a prisoners of war camp

When the flies are common they are to be seen on pieces of string or wire in meat markets. When abundant they assemble in groups on various objects such as doors, wire screening and a waste paper basket. Such groups are sometimes caused by flies being attracted to one of their number which has been squashed. On steamers *C. putoria* have sometimes been seen in groups of three to ten on ceilings.

The flies are attracted to meat and human faeces and to the masses of rotting mangoes which are seen in the south in May. They do not normally walk over human food (other than meat) or eating utensils, but sometimes do so by accident when they are abundant. On one occasion some cakes were seen to be quite free of these flies, although a few house-flies were crawling on them, yet within few yards was a large trench latrine containing many thousands of larvae and hundreds of adults of *C. putoria*.

This species has easily been bred in the laboratory for successive generations. For this purpose adults were placed in a glass battery jar with a capacity of 34 litres. It contained a dish of water to raise the humidity, some sugar solution and a dead toad (a convenient local source of meat) on which the flies could feed and lay eggs. The larvae were reared on dead toads or a mixture of these and cow-dung.

According to Gillet and Wanson (1946) *C. putoria* is the most dangerous house-frequenting fly in Leopoldville where it can breed in the darkest pit latrines. In the Sudan it is probably almost harmless in many places. Where it is abundant it may perhaps play some part in spreading intestinal parasites and is objectionable when it enters houses. It is conceivable that the larvae tend to liquify faecal material and so have an adverse effect on those of *Musca*.

Oil is ineffective for the prevention of breeding because larvae can climb above it at the side of a pit. Jettmar (1930) used hot water to control another latrine breeder, *C. megacephala*. Fifty-seven larvae of *C. putoria* were exposed in water for five minutes and 82 larvae for ten minutes to 49°C., and examined after 12 hours, when they were found to be all dead. Some survived similar exposure to 48°C. It is usually impracticable, however, to heat latrine contents to a lethal temperature. Many larvae were killed, in a single test, by orthodichlorbenzene applied at the rate of about 90 cc. per square metre in a pit with semi-liquid contents.

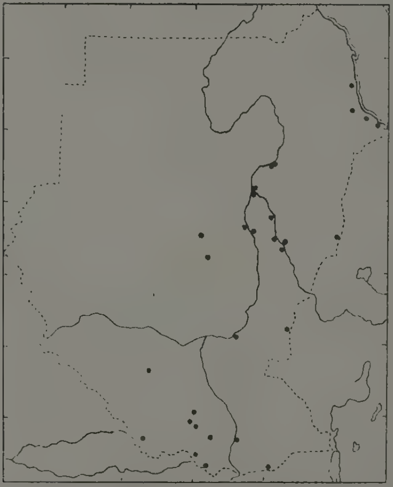

Fig. 5 : The known distribution of *Chrysomyia marginalis* in the Sudan.

Chrysomyia marginalis Wied. — Some caught specimens are metallic green instead of the usual metallic blue colour. When one is breeding adults of this species it is particularly important to keep them alive long enough for the wing markings to develop. Sudan localities are the Akot area (H.H.K.), Aqiq, K. Arbaat, Bara (Becker, 1923), Dingba, Dueim, Erkowit, Gandeto, Gwangba (J.G.M.), Ikoto (M.S.), Jambo's, the mouth of the Getti (Austen, 1906), Kawa, Khartoum (Longstaff, 1911), Lubia (M.S.), Malakal, Mongalla, Mvolo, Rahad, Sennar (Becker, 1923), Shambat, Shendi, Singa, « the Sudan » (Austen, 1906; Balfour, 1906), Tokar, Wad Arud, Wad Medani, Yeshkap and J. Zoro.

Hepburn (1943a) regarded *C. marginalis* as a good scavenger in South Africa and found that it was attracted to fresh carcases in preference to traps nearby. In the Sudan *C. marginalis* has been bred from carcases of cow, donkey and guinea-pig. Adults are often attracted to human faeces, and a few have been seen on « laot » flowers (*Acacia nubia* Berth.) at Gedaref.

Calliphorini

Lucilia

Lucilia (*Hemipyrellia*) *fernandica* Macq. occurs in various parts of the Ethiopian Region (Aubertin, 1931). It has been found at Ikoto (M.S.), Juba, Mvolo, Roseires and Wad Medani.

Lucilia (*Hemipyrellia*) *pulchra* Wied. is an Oriental species. Aubertin (1931) saw a single female from the Sudan but thought it might be an abnormal *L. fernandica*. Dr. Van Emden informs me that he has since seen males of *L. pulchra* from the Sudan repeatedly and proved their identity by dissection, but that he does not know it from other parts of Africa.

This species has been caught at Terakekka (on mango flowers) and Wad Medani (in trap baited with rotting cotton seed). It has been bred, at Wad Medani, from a dead bird and a dead guinea-pig and from the ulcerated leg of a living fowl, and the ulcerated submandibular region of a rabbit.

Lucilia (*Lucilia*) *cuprina* Wied. is predominantly an Ethiopian species which has become widely spread in tropical and subtropical regions, sometimes owing to its ability to breed in wounds (Aubertin, 1933). *L. argyrocephala* Macq. is a synonym, according to Curran (1928), under which Becker reported its presence.

Sudan records are from Bara (Becker, 1923), Delami, Gedaref, Geneina (N.M.G.), Hawata, Khartoum, Kodok, Maya Sinyora, Meridi, Mvolo, Nyinyar (A.K.A.), El Obeid (Becker, 1923), Roseires, Tonga, Tonj, Wad Medani (the common species), Yei and Yeshkap.

This species usually breeds in rotting meat but can breed in fowl manure (Waterhouse and Paramanov, 1950). In the Sudan it has been bred from dead rats and from larvae found in a camel's mouth at Wad Medani. No lesion could be seen but it appears that larvae sometimes infest man or animals without entering wounds. Aubertin (1933) quotes a record of *Lucilia* ovipositing on a fledgling missel thrush which had fallen from a nest, and the present writer has seen adult *Lucilia* attracted by a sick but apparently uninjured young cattle egret. Pick (1952) and Leclercq (1952) refer to larvae of *Lucilia* living on, but not in, the human body.

Adults of *L. cuprina* have been caught on meat and in traps baited with rotting lucerne and with rotting cotton seed.

Lucilia (*Lucilia*) *infernalis* Villen. occurs in Kenya, southern Rhodesia, Tanganyika and Uganda (Aubertin, 1933), and is known from Nagishot in the Sudan.

Lucilia (*Lucilia*) *sericata* Meigen, a Palaearctic species which has become more or less cosmopolitan (Aubertin, 1933), has been found at Khartoum in an aeroplane and once at Wad Medani in a fly trap.

Other genera

Auchmeromyia luteola (Fabr.). — The adult of the Congo Floor Maggot has been redescribed by Patton (1935). In the Sudan this species has been found at Adok, Agorti, Akoke, Atar, Bara (where it was reported by Balfour, 1909, in the rains from a prison in which the cement floor had cracked), K. Bugbar (J.G M.), Delami, Dilling, J. Fama, Fangak, El Fasher, K. Fullus, Gammeiza, Geneina, Heiban, Jokau (G.S.R.), Juba, Kajo Kaji,

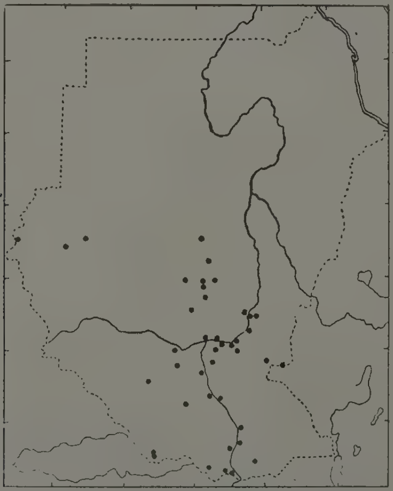

Fig. 6 : The known distribution of *Auchmeromyia luteola* in the Sudan.

Kaka, K. Kaya, Kenisa, Kelling, Li Rangu, Malakal, Melut (Mellor, 1922), Meshra er Req, Mongalla (Balfour, 1906), Nasir (King, 1908), L. No (H.H.K.), Okaro, Paloich, Rahad, Rumbek, Shambe, Tawfikia, Tiptiap, Tonga, Tubor, J. Umbri, Wau, Yambio, Yei and Bahr ez Zeraf km. 116.

According to Garret-Jones (1951) the larva of *A. luteola* has exceptional powers of resistance to starvation and desiccation and the species has a remarkable range from wet to dry regions. It exists in areas where people are permanently settled and sleep without raised beds to protect them from the maggots. Garret-Jones considers that in desert the absence of these conditions is more important than climate in limiting distribution. On page 704 an observation on oviposition is attributed to the present author which he did not make.

In the Sudan the distribution of *A. luteola* is apparently determined by the above-mentioned requirements and the species is, like *Cimex hemipterus* F., mainly associated with the southern tribes of the Sudan (Lewis, 1949).

In Dinka villages around Paloich Congo Floor Maggots are common in the huts of bachelors because these have floors of fine ash. The larvae are not found in the houses of married man which have floors of hard polished mud.

Choeromyia choerophaga Roubaud. — This species has been redescribed by Patton (1935) who points out that it and *Pachychoeromyia praegrandis* are associated with ant-bears and wart hogs. *C. choerophaga* is known from Torit (C.M.).

Pachychoeromyia praegrandis Austen. — This very large species is known from Keyala, Rahad (C.E.W.) and Yei (H.H.K.).

Cordylobia anthropophaga (Blanchard). — The male terminalia are described by Patton (1936). In the Sudan the Tumbu Fly is known from « Bahr el Ghazal » (Patton, 1922), Bara, Juba, Kadugli, Keilak, Khartoum, Kheirullah, Lui, Meridi, Mvolo, El Obeid, Singa, « the Sudan » (King, 1908; Patton, 1922), Wad Medani and Yei. It is a common cause of myiasis in the south, and has occasionally been found attacking man and dogs in Khartoum and Wad Medani.

I am informed by Captain G.S. Renny that this insect is often troublesome at Nasir where people, of the Nuer tribe, call the adult « man tec » which means the mother of the « tec » or maggot. They confuse it with the Congo Floor Maggot.

Bengalia minor Mall. is known from Wad Medani, *B. peuhi* (B. and B.) is widely distributed, and *B. spuria* (B. and B.) is known from Lado, Mvolo, Wan Akaic and Yambio. These common large flies, which are often seen waiting to take food from ants near houses, are sometimes received for identification. Mellor (1922) observed their habits at Shambat.

Phumosia (*Paratricyclea*) *pseudolucilia* Villen., which, as Malloch (1926) points out, is very similar to *Lucilia,* occurs at Lotti.

Phumosia congensis Zumpt and the large blue *P. molaris* Zumpt, other « metallic » species, are known from Nagishot and Ikoto respectively.

Hemigymnochaeta lutae Corti was found on cow dung at J. Haina (R.C. M.-D.), and other species have been taken at Nagishot and Wad Medani (in a house).

DISTRIBUTION

The Calliphoridae in general tend to be widely distributed in the Sudan, in contrast to the muscids other than *Musca,* many of which are restricted to the cool damp southern fringes of the country. *Wohlfahrtia* is mainly a semi-desert genus but occurs in the far south. Most species of *Sarcophaga* are very widely distributed in the Sudan. Five also occur in Egypt (Salem, 1936). Three of the five common *Chrysomyia* are widely distributed but have never been found on the Nile north of Shendi.

The species of *Wohlfahrtia* exemplify the tendency of pale insects to occur in desert areas.

FLIES WHICH BREED IN CARRION

The Table shows eight species of Calliphorids which have been bred from dead guinea-pigs exposed for the purpose at Wad Medani. *Calliphora albiceps* was bred more commonly and in greater numbers than any of the others. Uusually when larvae of this species were numerous few individuals of other species emerged from pupae. According to Hepburn (1943 b)

Flies bred from 47 dead guinea-pigs at Wad Medani
between August, 1945, *and July,* 1946,
mostly between September and November

SPECIES	Number of times bred	Times when many bred	Times when many bred with many *C. albiceps*
Megaselia sp. (Phoridae), not always collected			
Wohlfahrtia nuba	16	4	—
Sarcophaga sp. (*globicauda*, *tibialis* or *nodosa* ssp., usually *tibialis*)	15	5	3
Chrysomyia albiceps	34	25	—
Chrysomyia putoria	5	2	1
Chrysomyia marginalis	2	—	—
Lucilia pulchra	4	—	—

sarcophagids are attracted to carcases in the later stages of decomposition and presumably many are killed by *C. albiceps*.

In bare semi-desert country the temperature of the soil surface becomes very high during the day. Buxton (1923 b) reported maxima of 78°C. and 84°C. on bare sand surfaces, and at Wad Medani in September a thermometer just covered by the clay soil reached a temperature of 76°C. several times in a few days. Few insects exist away from vegetation unless they spend the day in fissures beneath the surface of the soil. Carcases provide a microclimate in which calliphorid larvae can live, sometimes only a few centimetres from the heat of the soil surface which would kill them in a few seconds. On one occasion, for example, larvae of *W. nuba* were found in a dead vulture, and when the body was disturbed some fell out and died in a few moments when deprived of the shade of the skin and feathers. Similarly some larvae of *C. albiceps* were found dead near the carcase of a bull from which they had fallen.

Flies which breed in carrion in the Sudan are useful scavengers and usually appear to be harmless. They settle on meat but, as this is cooked, they are presumably of little or no importance in contaminating food. They may however transmit anthrax where it is prevalent, as Herms (1950, p. 40) has pointed out.

MYIASIS

Myiasis is of minor importance in the Sudan apart from trouble caused by *Auchmeromyia luteola* and *Cordylobia anthropophaga*. This fortunate state of affairs is attributable to the absence of various dangerous species, such as *Wohlfahrtia magnifica* and *Chrysomyia bezziana* (apart from one instance), and the dry climate and absence of thick-coated sheep which might suffer from « strike ».

The species concerned in cases of myiasis, some of which have been mentioned above, are as follows. *Wohlfahrtia nuba* is the only facultative parasite in wounds of man and camels known in the Sudan. It has also been found infesting a donkey, horse, rabbit and sheep. The notorious *Chrysomyia bezziana* has only been found once and is apparently not established in the Sudan. A few *Lucilia* larvae have been found in animals, *L. pulchra* in a fowl and a rabbit, and *L. cuprina* in a camel's mouth. *L. cuprina* and *L. sericata* are notorious as the cause of « sheep strike » in some countries (Aubertin, 1933) but not in the Sudan. The attacks of larval *Auchmeromyia luteola* are regarded as myiasis by Zumpt (1951). The related *Pachychoeromyia praegrandis* and *Choeromyia choerophaga* are known to attack wild animals in other countries, and *Cordylobia anthropophaga* is often troublesome in the south.

ATTRACTION TO MALODOROUS PLANTS

Several calliphoridis were seen on a few individuals of a fungus and a flowering plant of the family Asclepiadaceae growing at Wad Medani. The fungus, *Phallus* sp., attracted *Sarcophaga hirtipes*, *Lucilia pulchra* and *L. cuprina*. The flower of *Stapelia nobilis* N.E. Brown, a south African species, attracted *Chrysomyia albiceps, C. marginalis* and *Lucilia cuprina. L. cuprina* laid eggs on the flower. It is known (Strasburger, 1921) that some carrion flies are attracted to lay eggs on *Stapelia* and to pollinate it in doing so. The flower of another plant of the same group, *Caralluna retrospiciens* N.E. Brown, which occurs in the Red Sea Hills, attracted a species of *Musca*.

SUMMARY

This paper records the occurrence and known distribution in the Sudan of 47 species and one variety of Calliphorids, which are of medical interest or importance. Notes are given on the larval and adult habits of several species, particularly *Chrysomyia putoria* Wied., and on some taxonomic differences between *C. albiceps* Wied. and *C. putoria*.

There are short sections on distribution in general, flies which breed in carrion, myiasis and attraction to malodorous plants.

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Notes on the effect of some secondary environmental conditions on the activity of nocturnal Macrolepidoptera

(with 3 Text-Figures and 8 Tables)

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INTRODUCTION

These studies were carried out at Rothamsted Experimental Station. Harpenden (25 miles north of London). Nocturnal Macrolepidoptera were sampled between sunset and sunrise each night for two complete years by means of two ultra-violet light traps. These were situated in two different localities, though close to each other, one in the open and the other inside a thick woodland (about 14 acres altogether).

A total of 36.144 moths was caught during these two years in the trap out in the open (Trap G) and 22.773 moths inside the woodland (Trap F).

The numbers of the daily catches were transformed into their logarithms to facilitate their graphical illustration and to smooth down the frequency distribution curve of the data (see Williams, 1937). The form log. $(n+1)$ was used to avoid complication caused by the presence of zero catches.

On the first place the average monthly effect of the main weather factors on the activity of nocturnal Macrolepidoptera was worked out by means of the partial regression formula. In those calculations the mean-night, day maximum temperatures and night wind velocity were involved.

Details of these results will be published later.

In the present notes the following factors were tested, the moonlight (lunar periodicity), fog, duration of rainfall, thundery weather conditions (and barometric pressure), and wind direction.

The effect of the moon-light was tested in both trapping areas whereas only the catches in Trap G (in the open) were considered for the effect of the other factors.

I. LUNAR PERIODICITY IN CATCHES OF NOCTURNAL MACROLEPIDOPTERA

It is by now a well known fact that some animals, mostly marine, have periodicities of activity corresponding to lunar phases. Allee et al (1949) dealt with much of the information in this respect, and considered that in many cases the effect is tidal. Hora (1927), as quoted by Uvarov (1931), noticed in India that swarms of mayflies appeared usually about the full moon period. Pagden (1932) by trapping Pyralid rice pests in Malaya with a light trap showed that in six months six periods of maximum catch corresponded to new moon periods, and six periods of minimum catch corresponded even more definitely to the full moon periods.

Hussain and others (1934) studying the effect of temperature on the phototropic response of the adult cotton bollworm by means of a light trap in India wrote : « there is, however, some evidence which goes to prove that on dark nights greater numbers of moths were attracted than on bright nights ». He concluded that moon appears to affect the phototropic activities of this moth.

Williams in England (1936 and 1940) showed that in three successive years between May and October, the catches in a light trap both of Lepidoptera and of all insects together (mainly Diptera) reached a peak at, or shortly after, new moon, when the geometric mean of catches was three to four times as great as that at full moon.

Robertson (1939) analysing the catch of crane flies in Williams' light trap, came to the conclusion that on a night of no moon the insects were rather more than twice as numerous as on a full moon.

To see if the lunar periodicity of catches in light traps can also be found with other methods of trapping, Williams and Singh (1951) trapped insects at night by means of a «suction trap». This trap draws in insects by a strong electric fan and thus is in no way dependent on reaction to light. Analysing the figures after being corrected for temperature and wind, they got a geometric mean catch of all insects (chiefly Diptera) in the new moon week nearly five times that in full moon week. They concluded that the moonlight must have a definite effect on nocturnal insects, and that low catches in a light trap at full moon are not due to a reduction in the efficiency of the light as an attractant.

It remained necessary then to test the reality in the suggestions occasionally put forward that the moonlight effect on nocturnal insects was of an inhibitory nature. This was one of the main objects for setting a light trap inside a rather thick woodland as well as the one in the open, not far away from each other.

The moonlight

The effect of the moonlight was not included in the partial regression analysis of activity merely because of the difficulty involving the accurate measuring of its intensity, owing to the fact that both duration and intensity depend on the time of rising and setting of the moon, its phases, its angle above the horizon, and interference by clouds. On an average the moon rises and sets 49 minutes later every day, but the interval varies from 12 minutes to one hour and thirty three minutes and is not the same for rising and setting on the same night. In each lunar month except in the winter there is a cycle changing from long differences to short differences and then back again. In the summer the moon is low at full moon with a minimum angular height above the horizon of 12° at London in June; in winter, it is high at full moon with a maximum angular height of 66° in December and as a result of this the winter full-moon light is much brighter than the summer one. The reverse is the case with new moon, which is lower in winter and higher in summer.

As for the nature of the moonlight itself it can be said that it is merely a reflection of the sunlight greatly weakened by the distance and by the fact that the moon is an imperfect reflector. It is unlikely, except for some polarisation, that moonlight has any properties not found in sunlight.

Method of analysis

The daily log. catches (n+1) in Trap G (in the open) were first corrected for the three weather factors, as indicated by the partial regressions of the month. For the catches in Trap F, however, the corrections were made for the factors of mean night and day maximum temperatures only, as the wind had shown very little or no effect inside the wood, especially in the summer months. The corrections in such case would leave values for the catch which would have been obtained under normal conditions of these weather factors during the month. The following example describes more clearly the correction procedure :

The log. catch (n+1) of Macrolepidoptera in Trap G for the night of 21st July 1952 was 2.958. The departures from the monthly means on the same night were +8.9° F. for the mean-night temperature, +7.4° F. for the day's maximum temperature and —0.5 for the mean-night wind velocity in groups. The calculated partial regressions, however, for the month of July 1952 on these three weather factors were +0.066, —0.008 and —0.186 respectively. The corrections for the departures on that day's catch would be : $+8.9 \times +0.066 = +0.5874$ for the night temperature, $+7.4 \times -0.008 = -0.0592$ for the maximum temperature, $-0.5 \times -0.186 = +0.1930$ for the wind velocity. Total correction $= +0.6212$.

Accordingly, the sum of 0.621 had to be substracted from the 2.958 representing the log. catch and thus the new figure becomes 2.337, which is the estimate for the catch had the night been average.

The resulting corrected figures were then arranged in groups of seven, each including three days before and three days after the day on which either of the four lunar quarters occurred. The mean log. for each of these weeks in the six summer months, May to October, was worked out. These means were used for comparison between new moon and full moon weeks, and formed the basis for the analysis of variance. Table I (a, b, c and d) give these means for the catch of all Macrolepidoptera in two summers in each trap.

TABLE I

(a)

Mean log. catches of Macrolepidoptera in Trap G (in the open) during six lunar cycles in 1951.

MONTH	NM	FQ	FM	LQ
May . . .	0.975	0.956	0.725	0.715
June . . .	1.186	1.292	1.407	1.939
July . . .	2.059	2.149	2.354	2.251
August . .	2.316	2.145	1.766	2.156
September .	2.333	2.326	1.679	2.243
October . .	2.360	2.084	1.392	1.291
MEANS	1.872	1.825	1.554	1.766

(b)

Mean log. catches of Macrolepidoptera in Trap G (in the open) during six lunar cycles in 1952.

MONTH	NM	FQ	FM	LQ
May . . .	1.473	1.669	1.259	1.319
June . . .	2.009	2.167	1.941	2.286
July . . .	2.257	2.117	2.172	2 561
August . .	2.072	2.037	1.774	1.977
September .	1.611	1.925	0.976	1.437
October . .	1.569	1.011	0.846	1.460
MEANS	1.832	1.821	1.495	1 840

(c)

Mean log. catches of Macrolepidoptera in Trap F (inside the woodland) during six lunar cycles in 1951.

MONTH	NM	FQ	FM	LQ
May . . .	1.185	1 055	0.827	0.654
June . . .	0.957	1.289	1.475	1.688
July . . .	1.934	1.849	2.067	2.085
August . .	1.840	1.879	2.100	1.849
September .	1.794	1.806	1.669	1.695
October . .	1.519	1.388	1.449	1.392
MEANS	1.538	1.544	1.598	1.561

(d)

Mean log. catches of Macrolepidoptera in Trap F (inside the woodland) during six lunar cycles in 1952.

MONTH	NM	FQ	FM	LQ
May . . .	1.290	1.592	1.302	1.138
June . . .	1.982	2.340	1.971	2.066
July . . .	2.314	2.153	2.338	2.465
August . .	1.974	1.894	1.898	2.012
September .	1.178	1.298	1.207	1.345
October . .	1.645	1.087	1.270	1.176
MEANS	1.730	1.727	1.664	1.700

The geometric mean catch per night during a complete lunar cycle in six months was also worked out and a five day running mean of these values was calculated to eliminate the time trend. The reconversion to (anti log. —1) of the final figures gives the smoothed geometric mean number of moths caught per night during six lunar cycles (Fig. 1. A. B. C and D).

The analysis of variance and test of significance for the difference between the means of full and new moon weeks were worked out in almost every case.

Discussion of the results

Table Ia gives the mean corrected log. catches of Macrolepidoptera in each moon quarter (mean of seven days) during six summer months, May to October 1951, in Trap G (in the open). The total mean during this period for the new moon week, as can be seen from that Table, was 1.87; and the corresponding mean for the full moon week 1.55. The mean log. catch at new moon was thus +0.32 over full moon. Being on log. basis, this difference indicates a mean catch per night during new moon slightly more than double that at full moon week. Table II shows the analysis of variance as well as the standard error, the t value and the significance level of this difference.

TABLE II

Trap G (in the open) 1951

	DEGREES OF FREEDOM	TOTAL VARIANCE	MEAN VARIANCE
Between months . .	5	5.566	1.113
Between quarters .	3	0.354	0.118
Error	15	1.368	0.091
Total	23	7.288	0.317

s. e. = $\pm$ 0.174 t = 1.83 P = 0.10 — 0.05

It is evident from this analysis that the error is comparatively high and so the difference between new and full moon weeks was only significant at between 5 and 10% level.

Figure 1 A illustrates the mean day to day corrected log. catch, figures being smoothed to a five-day running mean and reconverted to anti-log. (n-1).

It can be seen that the peak, with an average of 77 moths per night, was reached on the second day after new moon, after which the numbers declined gradually to a minimum of 32 insects on both full moon day and the day before.

In 1952 a similar analysis was carried out for the catches of Macrolepidoptera in the same trap (Trap G, in the open), during a similar period of six summer months. The quarterly geometric means for that year are given in Table I b, together with the 6 months means. It is evident from this Table, that there has been a difference of 0.337 in the six months' mean catch between full and new moon weeks. This difference indicates that on an average the log. catch during new moon week was again more than double that on full moon week, in the six summer months of 1952. The analysis of variance and significance level for this difference are given in Table III.

The lunar cycle in the summer of 1952 had thus affected the catch of Macrolepidoptera in Trap G in almost the same proportion, as in 1951, and with a higher level of significance (2-1% level).

TABLE III

Trap G (in the open) 1952

	DEGREES OF FREEDOM	TOTAL VARIANCE	MEAN VARIANCE
Between months . .	5	3.59	0.719
Between quarters .	3	0.51	0.170
Error	15	0.67	0.045
Total	23	4.77	0.207

s. e. = $\pm$ 0.122   t = 2 76   P = 0.02 -- 0.01

The smoothed daily means are shown graphically in Figure 1 B and it appears that the peak was more spread as compared with that of 1951, with a definite minimum at full moon. The broad peak of the mean catches is partly at least due to high catches in the first and last quarters in some of the months (Table I b).

For the catches in Trap F (inside the woodland) in both years the case was different.

In the six summer months (May-October) 1951, neither the individual quarter log. means during separate months nor the six months means as given in Table I c, have shown any reduction in the mean log. catch at the full moon week as compared with new moon week. On the contary, there was a small non-significant increase at full moon week of 0.060 log. catch (equal to about 15%) *over* the new moon week in the six months' means. Figure 1 C illustrates the average number of moths caught per night during the six lunar cycles of 1951, inside the woodland. It is clear from this illustration that the values formed an irregular sinusoidal curve with a number of indistinct troughs and peaks throughout the lunar cycle. An analysis of variance or test of significance was thought unnecessary in this case.

On the other hand the six months' means of 1952 as given in Table I d showed a slight reduction at full moon week as compared with new moon week, but the difference in this case was again about 16% (0.066 log. catch) which is also too small to be significant as can be seen from the analysis of variance given in Table IV.

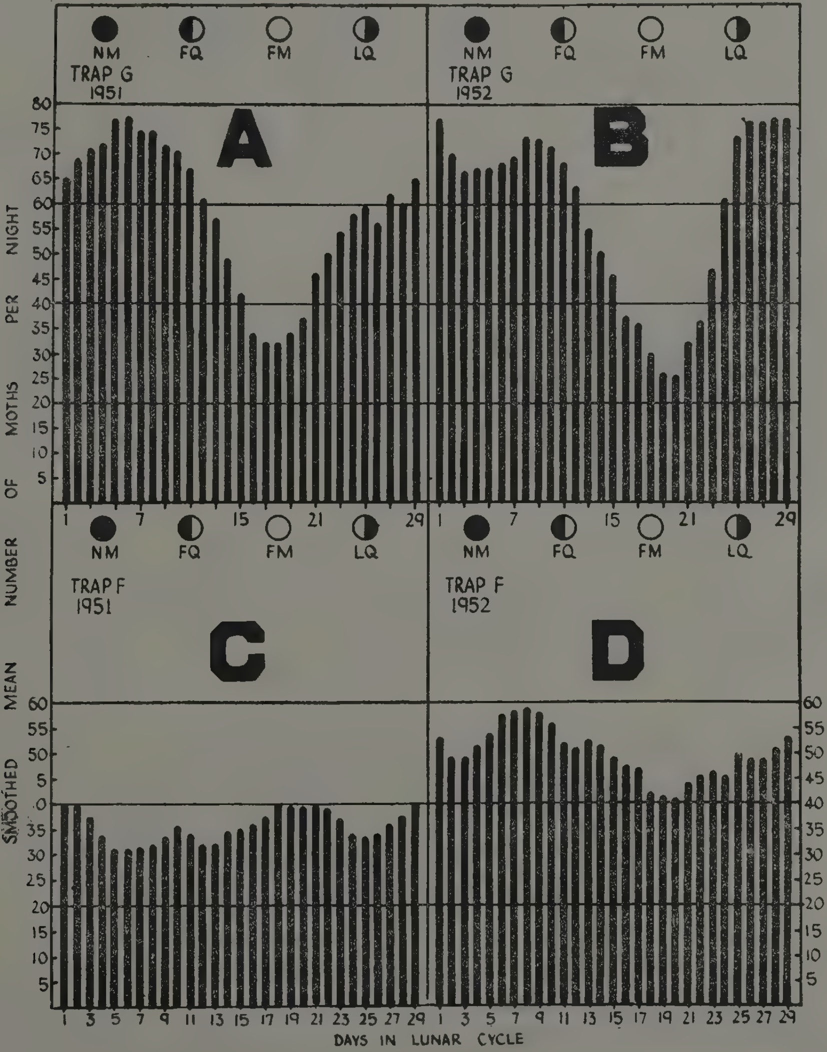

Fig. 1 : Lunar periodicity of nocturnal macrolepidoptera.

Figure 1 D illustrates the behaviour of the geometric mean catch per night in the six months of 1952 during the lunar cycle.

TABLE IV

Trap F (inside the wood) 1952

	DEGREES OF FREEDOM	TOTAL VARIANCE	MEAN VARIANCE
Between months . .	5	4.36	0.872
Between quarters .	3	0.02	0.007
Error	15	0.43	0.029
Total	23	4.81	0.209

s. e. = ± 0.098   t = 0.673   P = 0.6   0.5

Conclusions

In the light of the results discussed above it may be concluded that the moonlight in full moon week had a negative effect upon the catch of nocturnal Macrolepidoptera. Being nocturnal insects it is likely that a degree of general lighting forms an unfavourable environmental condition for their activity in the open as indicated by catches in Trap G. This reasoning is supported by their tendency to maintain normal activities in sheltered areas, such as thick woodland, as has been shown by the results obtained from catches in the light-trap F.

A further support might be found in the results shown in Table V for the corrected log. catches in the latter trap when the woodland was free of leaves, and thus in a state more similar to that of the open. By the end of October 1951, the trees of the woodland started shedding their leaves, whereas in 1952 the falling of the leaves took place about a month earlier and so the woodland condition in October 1952 was similar to that of November 1951. Accordingly, the corrected mean log. catch per phase during these two

TABLE V

Mean log. catches of Macrolepidoptera during the lunar cycle in Trap F (inside the wood)

MONTH	YEAR	NM	FQ	FM	LQ
March . . .	1951	0.763	0.863	0.492	0.674
	1952	1.016	1.045	0.581	0.843
November. . .	1951	1.244	1.037	0.825	0.850
October . . .	1952	1.645	1.087	1.270	1.176
MEANS		1.167	1.008	0.792	0.886

months together with the means for the two months of March were considered.

Table V shows clearly the definite reduction in the mean log. catch during full moon week in each month, as compared with the means of new moon week. The means of the four months together for each quarter give evidence of an undoubtedly significant difference between means at full and new moon weeks when the woodland is bare.

A brief test of a possible lunar periodicity in diurnal insects

Having seen that catches of nocturnal insects had shown definite lunar periodicities in the open it was thought interesting to test whether or not diurnal insects would show similar phenomena. It happened that Singh (1952) was running a powerful suction trap from March to November 1951 for two hours daily at mid-day in the same area of light trap G (in the open), to sample diurnal insects (mainly Diptera) for a different investigation. His data were adopted for the present attempt by arranging the daily log. catches in the lunar cycle in the same way as that used for the light trap catches previously discussed. The monthly means per phase together with the general « all 9 months » means and those for the 6 summer months May to October only, are given in Table VI.

TABLE VI

Mean log. catches of diurnal insects in a suction trap (in the open) during 9 lunar cycles in 1951

(Italic figures indicate the maximum mean per cycle)

MONTH	NM	FQ	FM	LQ
March	0.61	1.36	*1.62*	1.40
April	2.03	*2.17*	2.08	1.75
May	1.48	1.61	2.16	*2.27*
June	2.16	*2.35*	2.29	2.12
July	2.24	2.36	*2.45*	2.23
August	2.26	2.30	*2.39*	2.28
September	2.52	2.52	2.43	*2.60*
October	*2.30*	2.25	2.28	2.05
November	*2.35*	2.17	1.18	2.02
MEAN ON NINE MONTHS	1.99	2.12	2.18	2.02
MEAN OF SIX SUMMER MONTHS MAY-OCTOBER	2.16	2.23	2.33	2.26

It is obvious from Table VI that the cycle maximum averages were more or less evenly distributed in all phases. Both the nine and six months means show a slightly higher value at full moon than at new moon, but the differences are too small to be significant. In fact the 6-months means for the four quarters follow closely the pattern observed in the corresponding means for nocturnal Macrolepidoptera in light trap F (inside the wood) during the same period (May-October 1951). Figure 2 illustrates this resemblance which may be due to similar general changes in population level of insects in that period.

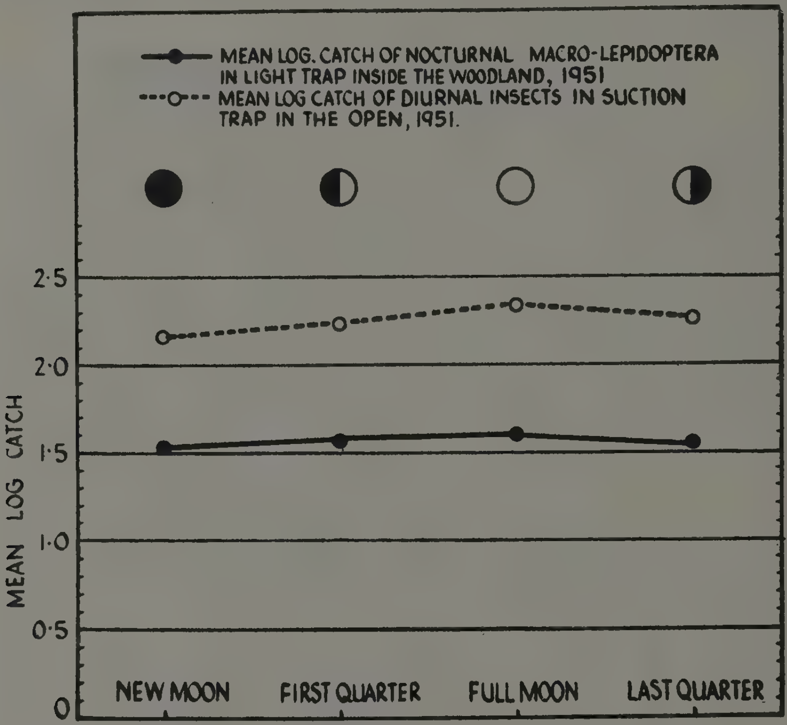

Fig. 2 : Mean log. catch of nocturnal macrolepidoptera.

It may thus be concluded, that although only one year's data are considered in this test there is no evidence for a lunar periodicity in the activity of diurnal insects in the open.

II. FOG

Fog has a biological importance both as a factor interfering with the vision of insects and also as a case of an extremely high humidity. These two effects are difficult to separate.

In general, fog occurs on calm nights with temperature below normal during the late autumn and winter months. The catches in the trap at this period are usually poor and inadequate for reliable analysis. However, ten nights with fairly thick fog were recorded at Rothamsted during May, September and October 1951, and on these the fog persisted for the whole or greater part of the night. No similar fog conditions occurred between May and October 1952, and so the analysis was limited to 1951.

To get information about the nature of insect activity on foggy nights the departures of the corrected log. catch for the main weather factors from a 29 day running mean of these corrected figures were worked out for each of the ten nights. These are given in Table VII. As the corrected figures are more or less free from the influence of mean-night tmperature, day maximum temperature and mean wind velocity of the night, the departures from the mean in this case are assumed to indicate the differences in activity from normal which may be attributed largely to the fog. It must be remembered, however, that neither the density of the fog nor its duration could be measured.

TABLE VII

Departures of corrected log. catch of Macrolepidoptera for three main weather factors from the corresponding 29-day running mean on ten foggy nights in 1951.

Trap G (in the open)

DATES (YEAR 1951)	CORRECTED LOG. CATCH	CORRESPONDING 29-DAY MEAN	DEPARTURES
4th May.	0.871	0.835	+ 0.036
5th May.	0.791	0.869	− 0.078
27th May	0.825	0.928	− 0.103
22nd September . .	2.537	2.144	+ 0.393
29th September . .	2.980	2.039	+ 0.941
3rd October . . .	2.557	2.065	+ 0 492
8th October . . .	2.170	1.849	+ 0.321
9th October . . .	2.195	1.826	+ 0.369
15th October . . .	1.637	1.683	− 0.046
15th October . . .	1.576	1.666	− 0.090
MEANS	1.814	1.590	+ 0.224

On the whole, the mean corrected log. catch as averaged from the 29 day running mean was +0.224, which is equivalent to a catch of 67% above normal. As the standard error of this mean is more or less 0.108, the difference is then just significant at 5% level.

It is thus evident that on foggy nights the catch tends to increase and the cause of this is probably one of the following :

(1) The high negative saturation deficiency prevailing on foggy nights.

(2) The nature of the light as seen through the fog. The chief difference in this case is, of course, that it will be at a distant relatively richer in the long wave-length in the orange and red. Thus, species of moths that are more readily attracted to lights within that spectrum would be caught.

(3) The increase in the diffusion of the light by the fog particles. In this case the size of the luminous area increases and so its relative attractiveness to certain insects, especially those approaching the area from above the fog level may also increase.

Ficht and Hienton (1941) studying the activity of European corn borer moths showed that the luminous area is of importance since the larger the diameter used the greater was the number of moths attracted.

This third explanation may also be supported by the following incident : Williams (1940) observed that on the dense foggy night of the 28th September 1933 the catch of Lepidoptera in his two light traps (one at 4 feet and the other at 35 feet, but on the roof of a building) was well above the normal for the month, despite the 6.1° F. deficit in the minimum temperature of that night compared with the month's mean. Twelve individuals of the species *P. meticulosa* Linné were caught in the upper trap out of a total of only 37 individuals captured in both traps in four years of continuous trapping.

During the present investigation, 521 *P. meticulosa* were caught on two foggy nights of the 29th September and 3rd October 1951 in Trap G (in the open) out of a total of 990 for the year. Only 66 were captured in 1952 (1), during which no dense fog occurred between May and October.

The above figures and observations suggest that this particular species possibly flies high and thus may approach the area above fog level.

So it appears as if the light as diffused by the fog may be specially attractive to insects flying in the dark above the fog level.

III. DURATION OF NIGHT RAINFALL

To test the effect of the duration of the rainfall on the activity of nocturnal Macrolepidoptera, all nights with over two hours rainfall from May to October in 1951 and 1952 were selected. Again the method of departures of both actual log. catch, and corrected log. catch for the three main weather factors from 29-day running mean of the corrected values was adopted. Table VIII gives the results of the analysis performed on 32 nights.

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(1) It might be mentioned that an amateur entomologist, Captain T. Dannreuther, recorded many thousands of *P. meticulosa* at the beam of a searchlight on certain nights during the war years.

It is evident from this Table that there was an average positive departure of +0.130 log. catch on rainy nights which indicates that about 35% above normal catch was obtained on such nights. This result was more or less a surprise as a negative effect in this case was expected. The standard error of the difference is more or less 0.074 giving a t value of 1.76, which is significant between 10-5% level.

TABLE VIII

Mean difference from normal of actual and corrected log. catch « Macrolepidoptera » on 32 nights with over 2 hours of rainfall.

Trap G (in the open) 1951 and 1952

	ACTUAL LOG. CATCH	CORRECTED LOG. CATCH
Mean difference.	+ 0.130	+ 0.041
Standard error of difference . . .	± 0.074	± 0.052
t value	1.76	1.00
P	0.10-0.05	—

As rainy nights are cloudy and therefore warmer on average the departures of the corrected log. catch were much less indicating an average positive departure of only +0.041 log. catch on rainy nights or a catch equivalent to 10% above normal. Although this difference is not significant (as can be seen from Table VIII), it still records a tendency in the catch to increase and not to decrease, on rainy nights. This result undoubtedly emphasizes the need for a detailed study of the effect of this factor. The only explanation of this phenomenon that one can think of is that it may be due to the effect of some factors, other than temperature and wind, which are also associated with rainy weather (humidity, pressure, radiation, etc.), thus causing the insects to become generally active before, after or perhaps during the rain.

IV. THUNDERY WEATHER CONDITIONS AND BAROMETRIC PRESSURE

There is a widespread idea among collectors of Lepidoptera that moths may be captured more abundantly during conditions of thundery weather (Williams, 1940). Marchal (1912) collected evidence to show that the electrical state of the atmosphere influenced the flight activity of vine moths. To test this general belief a similar procedure to that used in the cases of fog and duration of rainfall was adopted. The log. catch figures considered here were those of 17 occasions between May and October of the two years on which meteorological observers at Rothamsted have recorded thundery weather over or near the trapping area. The corrected log. catch for the main weather factors on these dates, the corresponding 29-day running mean of the corrected values and the departures of both the actual and corrected log. catch from these means were also worked out.

A mean difference of +0.095 actual log. catch (equivalent to a catch of 24% above normal) was obtained during these 17 nights. With log. catch corrected for mean-night and day-maximum temperatures and for mean wind velocity a difference of +0.066 (16% above normal) was obtained as an average increase in the log. catch that may be accounted for by thundery weather conditions. In other words, about 8% « above normal » log. catch on thundery nights was due to temperature and wind conditions prevailing on these days. The other 16% remains to be accounted for by abnormal thundery conditions. As the standard error was more or less 0.098 for the mean difference of the actual log. catch and more or less 0.063 for the corrected log. catch both differences become non-significant. Thus no definite conclusions can be drawn at present as regards the effect of thundery weather on the activity of Macrolepidoptera.

Wellington (1946) stated, however, that since the moths were more active before thunderstorms it is possible that pressure influenced their activity. He also quoted a number of workers who supported his hypothesis which attributed the activity of Muscid Diptera before thunderstorms to their capability of receiving sonic vibrations and thus responding to changes in pressure ahead of a thunderstorm. He presented various workers' observations on the effect of barometric pressure and came to the following conclusion : « There is enough variation in atmospheric humidity and temperature, when changes in activity and pressure take place, to indicate that the change in activity is not solely dependent upon the pressure changes ».

Lutz (1929) showed that ordinary changes in pressure occuring in nature can be hardly of any direct importance in insect life. Also Cook (1920), could not find a significant effect of air pressure during the night on the activity of nocturnal Noctuidae. On the other hand, earlier in 1917 Pictet, as quoted by Uvarov (1929), showed that there is some evidence that the general activities of insects increase with barometric depressions and that depressions influence the length of the pupal period as well as the emergence from the pupae in butterflies and moths.

However, partial regressions were calculated during 1951 to see if there was any effect of day to day changes in barometric pressure on the activity of nocturnal Macrolepidoptera as a whole and on certain individual species. In all cases little was gained by the presence or absence of this factor in the calculations, and no definite effect could be traced.

V. WIND DIRECTION

The analysis of the effect of « wind direction » is made difficult by the fact that over England westerly and south-westerly air streams are usually warmer than others. The wind changes rapidly in both speed and direction

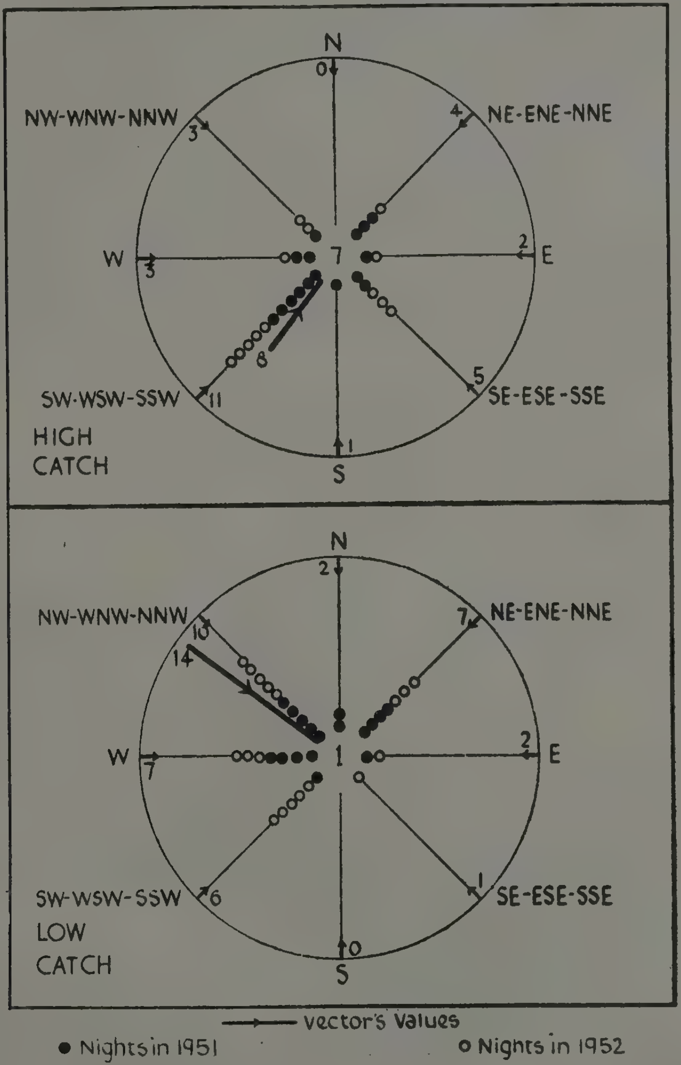

Fig. 3 : Wind direction on nights of high and low catches (Trap G).

not only from day to day but even within a single night. With that in view and at the same time to get an idea about its relation to insect activity the average wind direction on nights of the highest and lowest catches in Trap G (in the open) was considered. In all, 36 values were available, three for each month from May to October in two years. Figure 3A shows the frequency distribution of nights with wind in each of eight compass directions when catches of Macrolepidoptera were high. The number of nights with calm or light winds are given in the middle of the circle. Figure 3B illustrates the corresponding distribution for the low catches.

It is evident from this that there is a tendency in nights of high catches to have either calm and light winds or winds blowing from a south-westerly direction. The Vector value, shown as a thick solid line in the graph gives a value of 8 units from a south, south-westerly direction.

Nights of « low catches » on the other hand give the impression of stronger winds. Westerly and north-westerly winds are more frequently represented. The Vector value in this case was 14 units from a west, north-westerly direction.

VI. SUMMARY

The effect of some environmental conditions on the activity of nocturnal Macrolepidoptera as indicated by catches in ultra-violet light traps was studied. Certain statistical and mathematical procedures were adopted for the analysis and the following results were obtained as regard each factor :

(1) Moonlight (lunar periodicity) : In the open during new moon week an average log. catch was obtained in the six months (May-October) of two years which was double that of full moon week. The mean difference between the two weeks was found to indicate a significant negative lunar periodicity of Macrolepidoptera in the open. Catches inside a woodland did not show such a phenomenon during this period when there was a thick covering of leaves, but they did show a similar difference in the early spring and late autumn when the canopy was fairly bare.

(2) Fog : The mean log. catch showed a significant difference equivalent to a catch of 67% above normal on 10 foggy nights thus indicating that fog has a positive effect on activity.

The following three causes were suggested as an explanation for this phenomenon : (a) the high negative saturation deficiency prevailing on foggy nights ; (b) the nature of the light as seen by the insects flying through the fog : and (c) the increased relative attractiveness of the luminous area caused by the increased diffusion of the light on foggy nights to insects flying above fog level.

Evidence is presented to support the third explanation.

(3) Night duration of rainfall: Catches showed a tendency to increase by about 10% above normal on nights with over two hours duration of rainfall. This increase, however, was too small to be significant and could have easily been due to factors associated with rainy weather other than the mean night and day maximum temperatures and the average wind velocity during the night, for which the catch values were corrected in the first place.

(4) Thundery weather conditions and barometric pressure: On 17 nights between May and October of two years thundery weather conditions in the neighbourhood of the trapping area were recorded. Again a tendency in the catch to increase on such nights was observed, but the increase (16% above normal) was not significant and no definite conclusions could be drawn.

No evidence was found to show that barometric pressure exerts any influence upon the catches.

(5) Wind direction: The average values for this factor on the nights of highest and lowest catches (36 nights in each case) were analysed. Calm, light or south south-westerly winds were mainly associated with high catches, whereas north-westerly winds were comparatively frequent on nights with minimum catches.

VII. ACKNOWLEDGMENTS

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Temperature as a factor controlling the commencement of honeybees flighting and honeybee flight activity distribution during the various months of the year

[Hymenoptera : Apidae]

(with 7 Text-Figures and 5 Tables)

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I. TEMPERATURE AS A FACTOR CONTROLLING THE COMMENCEMENT OF HONEYBEES FLIGHTING

1. Introduction and review of literature

The purpose of this study is to obtain information on the relationship existing between the maximum and minimum temperatures of the atmosphere and the temperature at which bees start and cease to fly at different times of the year.

Since bees are cold-blooded, the temperature of individual bees must be very close to the air temperature in which they are flying. According to Pirch (1923) the temperature of the body of an individual bee varies and is the same, or almost the same as that of the air surrounding it, but

Snodgrass (1925) suggests that bees in active motion have a temperature slightly above that of the air about them because they liberate a large amount of heat generated by the action of their muscles.

Lundie (1925) in U.S.A. concluded that air temperature outside the hive was important, and that bees rarely left the hive for free flights until the outside temperature reached about 50° F.

Phillips (1945) stated that the individual bee can move the muscles which activate the legs at a temperature as low as 45°F., but that the wing muscles fail to lift the body at air temperatures lower than 50°F. He also stated that after the emergence of the last brood in the autumn bees do not cluster and do not fly from the hive but remain inactive on the comb, even on bright days, if the temperature remains about 60°F., and at this time of year there is less activity in the hive than at any other season. In colder weather the bees form a single compact cluster and leave the hive only occasionally on warm days for cleansing flights. Bees do not normally discharge their faeces within the hive, and even after a short period of confinement will venture out as soon as the outer temperature permits of flight. They may try to fly for this purpose at 50°F. if defaecation is necessary, but will remain quietly in the hive at 70°F., if no cleansing flight is needed. Bees wintering in the open fly when the outside temperature permits, and after a considerable period of confinement many will actually fly when it is so cold that they become chilled and unable to return.

According to Corkins (1930) at Wyoming, bees in hives with all types of heat insulation fly at about the same hour, though the reaction each day in colonies wintered in the single packing case was slower and less general. Generally good cleansing flights occurred during periods when there was a mean temperature of 35°F. or higher, smaller numbers of bees flying at temperatures down to about 30°F.

Kelsey (1945), Whitehead (1945) and Wedmore (1945) in England stated that bees wintered out of doors would fly when temperature rose to 45-50°F. in the shade. Wedmore concluded that some hardy bees, notably the dark races, flew at lower temperatures than those from warm climates.

Walker (1945) in U.S.A. kept two colonies, one in a « Vermiculite » insulated hive and the other in a hive wrapped with one thickness of black paper. During 1944 he recorded a cleansing flight at 34°F. and a general flight at 36°F. from the latter hive, whilst the lowest degree of temperature at which a cleansing flight took place from the insulated hive was 40°F. and for the general flight 44°F. He sohwed that during 1944 bees could fly at temperatures as low as 34 to 48°F. During 1945, Walker used the insulated hive and the other one with no protection and recorded some flight activity at

36°F., a cleansing flight at 41°F., and a general flight at 43°F. from the unprotected hive, and some flight at 44°F. from the insulated hive; he found that bees flew at temperatures as low as 36°F. during January and February. He recorded that bees of both hives in April were flying freely at temperatures as low as 42°F. but that no flights occurred at the lower temperature if there was even a slight wind.

Now that a recording device has been constructed which is capable of showing accurately the time at which bees fly (Fig. 1. (S)), more detailed studies than those based on direct observation, are made possible.

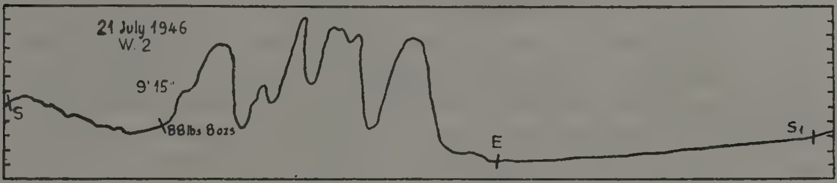

Fig. 1 : Daily curve showing a small day-time gain in colony weight and a night-time loss in colony weight (S = point at which bees started to fly; E = point at which bees ceased flying activity).

2. Method

Records of colony W. 2 between January 1st 1945 and September 30th 1946 and of colony W.5 between June 15th 1945 and September 30th 1946, each kept on a chart recording weighing machine at Rothamsted, were examined in order to determine on which days appreciable numbers of bees were flying. These records were compared with temprature records.

On each of the 638 days the temperatures at which the bees (of colony W.2 and the mean of colonies W.2 and W.5 since June 15th 1945) commenced and ended flying were obtained and were grouped together for each month. Maximum and minimum air temperatures for the day were recorded, together with the difference between the temperature at which the bees commenced to fly and the minimum temperature, and the difference between the temperature at which the bees ceased flying and the maximum air temperature. All temperatures were measured to the nearest 0.5°F. The number of days on which flighting was recorded and the mean average of all these categories for each month during 1945 and 1946 until the end of September 1946 is also calculated.

3. Results

The percentage of days on which flighting occurred varied between 9.7% (January 1945 and 1946) and 100% in June 1945 and 1946.

Observation showed that the temperatures at which the bees flew varied markedly at the different seasons of the years, even during a single month. There was a close relationship between the temperature at which flying occurs and the minimum temperature in the early morning of the same day. The bees did not commence to fly until there was a distinct rise in temperature.

The records available show that bees continue to fly until the temperature starts to decline, where upon activity rapidly decreases.

4. Correlation between air temperature and the temperature at which flight starts and ceases

There were highly significant positive correlations between the temperature at which bees commenced to fly and the daily minimum temperature. This indicates that the lower minimum temperature for the day the lower the temperature at which the bees will fly. In all the cases examined the correlation were highly significant.

Similarly the correlation coefficient between the temperature at which bees ceased to fly and the maximum temperature for the day was highly significant and was also positive. This indicates the close relationship between these two variables and that the time of the maximum temperature is a limiting factor which determines the duration of flight during each day.

5. At what temperature will bees fly ?

In 1945 the lowest minimum temperature (17.2°F.) was recorded on the January 26th 1945, and the lowest temperature at which bees commenced to fly (21°F.) occurred on the same day. January 1945 has also the lowest average (21.7±3.92°F.) for the minimum temperature and the lowest average (26.3±4.73°F.) for the temperature at which bees commenced to fly. The highest minimum temperature (62.6°F.) occurred on September 12th 1945, and the highest temperature at which the bees commenced to fly (69°F.) on the same day. July 1945 had the highest average (53.2±4.91°F.) for the minimum temperature and September 1945 the highest average (60±4.76°F.) for the temperature at which the bees commenced to fly.

During 1946, the lowest minimum temperature recorded at which flying activity occurred (23°F.) was recorded on a day on March 9th and the lowest temperature at which the bees flew (34°F) on the previous day; the highest minimum temperature (60.2°F.) was recorded on July 23rd 1946, and the highest temperature at which the bees commenced to fly (68°F.) on September 26th 1946.

In 1945 the annual range for the minimum temperature was 31.5°F. and the annual range of the temperature at which bees commenced to fly was

33.7°F. In 1946 the annual range of the minimum temperature was 27.1°F. but the annual range of the temperature at which the bees commenced to fly was 34°F.

Data in hand shows the great variation in the range of the minimum temperature and the temperature at which the bees flew from month to month in the two years under consideration. The range, however, is not a good measure of dispersion because it is based only on highest and lowest observations, instead of on all the available information. Therefore, the standard deviation has been calculated as a more useful measure of scatter.

The time at which flying activity ceases is dependent upon a number of external and internal factors, but it seems that maximum temperature exerts a very high measure of control.

In 1945, the lowest maximum temperature (24.3°F) and the lowest temperature at which the bees ceased flight (23°F.) occured on January 26th, also in January 1945 the lowest average maximum temperature (29.3 ± 4.37°F.) and the lowest average for the temperature at which flight ceased (28.9±5.11°F.) occurred. The highest maximum temperature (82.8°F.) and the highest temperature at which bees ceased flight (81.5°F.) occurred on August 4th. The highest average maximum temperature (70.3±4.88°F.) and the highest average temperature at which the bees ceased flight (67.3±5.14°F.) both occurred in July 1945.

During 1946, the lowest maximum temperature for the active days recorded was 35.1°F. on March 8th, and the lowest temperature recorded at which the bees ceased flight (35°F.) on the same day. The highest maximum temperature (82.7°F.) occurred on July 2nd, and the highest temperature at which the bees ceased flying (72.5°F.) was recorded on August 4th. In January 1946 the lowest average maximum temperature (49.3 ± 5°F.) and also the lowest average temperature at which bees ceased flight (48±4.24°F.) were recorded, and in July 1946 the highest average maximum temperature (70.8±6.15°F.) and the highest average temperature at which the bees ceased flight (64.6±4.01°F.) occurred.

During 1945, the annual range of the maximum temperature was 41°F. and the annual range of the temperature at which bees ceased flight was 38.6°F. During 1946, the annual range of the maximum temperature was 21.5°F. and the annual range of the temperature at which they ceased flight was 16.6°F.

The lowest value, highest value, range, average and standard deviation of the difference between the temperature at which bees commence flight and the minimum temperature, and the difference between the maximum temperature and the temperature at which bees ceased flight have been calculated.

During May and July 1945 the lowest differences occurred on May 7th; 7th, 23rd and 24th June;16th July 1945. During April 1945 the highest rise in temperature (24.4°F.) occurred on April 10th. The annual range of the average rise in temperature was only 10.2°F.

In 1946, during June, July and August the lowest differences occurred on June 23rd, July 3rd and 20th, and on August 4th and 24th; and during April 1946 the highest difference (20.5°F.) occurred on April 19th. The annual range of the average rise was only 8.7°F.

No difference between maximum temperature and temperature of ceasing to fly was observed in most months except during April to August 1945. During May 9th 1945 the highest difference (13.6°F.) occurred. The annual range of the average differences was 3.8°F. during 1945.

During 1946, the lowest differences were observed during February, March and April. The annual range of the difference was 6°F.

The bees occasionally, continued flying when the temperature fell below that at which they started to fly. On April 10th 1946, they started to fly at a temperature of 59°F., the temperature later reached 62.7°F. and then began to fall until it reached 57°F. and the bees ceased flying, and on April 11th of the same year they started flying at a temperature of 60.5°F. and ceased flying at 59.5°F. (cloudy morning).

Table I shows the monthly means of the two periods January to September 1945 and 1946 and the monthly mean of the period October to December 1945.

TABLE I

MONTH	1	2	Difference between (2) - (1)	3	4	Difference between (3) - (4)
	Mean minimum temperature in °F.	Mean starting flight temperature in °F.		Mean maximum temperature in °F.	Mean end flight temperature in °F.	
January 1945 and 1946.	30	36	6	39	38	1
February ,, ,, ,,	40	49	9	52	51	1
March ,, ,, ,,	36.5	48	11.5	54.5	54	0.5
April ,, ,, ,,	40	50	10	59	57.5	1.5
May ,, ,, ,,	42	50 5	8.5	61.5	58.5	3
June ,, ,, ,,	49	52.5	3.5	64.5	61	3.5
July ,, ,, ,,	52.5	56.5	4	71	66	5
August ,, ,, ,,	51.5	56	4 5	67	63.5	3.5
September ,, ,, ,,	51	57.5	6.5	63	62	1
October ,, ,, ,,	44.9	57	12 1	60.1	60.1	0
November ,, ,, ,,	43.7	52.2	8.5	53.1	53	0.1
December ,, ,, ,,	35 6	44.4	8 8	45.4	45.4	0

June, July and August show the smallest differences between the temperature at which the bees commence to fly and the minimum temperature ;

in these months also the greatest difference between the maximum temperature for the days and the temperature at which bees ceased to fly.

Table II shows the correlations and regressions of monthly mean temperature at which the bees commenced to fly on monthly mean minimum, and of monthly mean temperature at which bees ceased to fly on monthly mean maximum temperature, calculated from differences between monthly means and yearly mean of the monthly means during 1945 and 1946.

TABLE II

VARIABLE	Monthly mean temperature at whicle bees commenced to fly		Monthly mean temperatnre at whicle bees ceased to fly	
MONTHLY MEAN	Corrolations (highly significant)	Regressions	Corrolations (highly significant)	Regressions
Minimum temperature 1945.	0.94	0.94		
,, ,, 1946.	0 93	0.55		
Maximum ,, 1945.			0 99	0.94
,, ,, 1946.			0.99	0.76

All the correlations are highly significant. The regressions were very similar in both bases in 1945 and lower in both cases and not so similar in 1946.

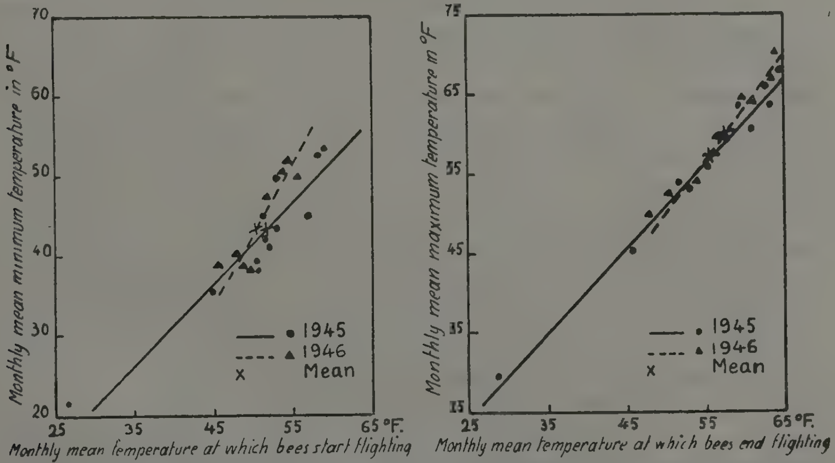

Fig. 2 : Scatter diagrams showing the relationship between monthly mean air temperature and the temperature at which bees start and cease to fly.

Figure 2 scatter diagrams showing the relationship between monthly mean minimum temperature and monthly mean temperature and monthly mean temperature at which bees ceased to fly during 1945 and 1946 are given; the regressions lines are also shown.

Figure 3 shows the commencement of flying (solid heavy line), the ceasation of activity (dashed line), the monthly mean maximum temperature (thin solid line) and the monthly mean average temperature (dashed and dotted line) and the monthly minimum temperature (dotted line) — abscissae: different months of the year ordinates : °F.

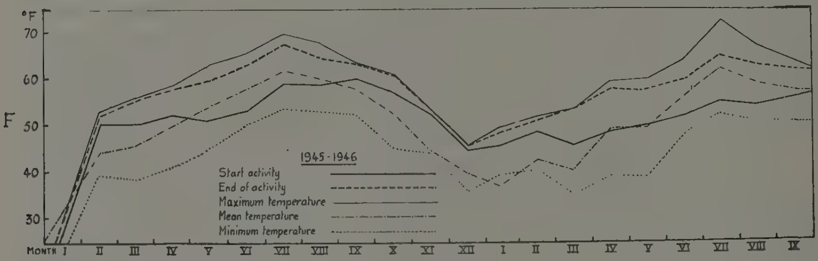

Fig. 3 : Curves showing the relation of the maximum, minimum and mean air temperatures to the temperature at which bees start and cease to fly (1945 and 1946).

In Figure 3 the close relationship between the temperature at which the bees commenced to fly and the minimum is shown. An increase in the minimum temperature is associated with an increase in the temperature at which flight occurs during February 1945; then a slight decrease followed by a slight increase could be seen in the two variables. This decrease in the temperature at which flying commenced which was observed during May was due to the flowering of various plants. The same stimulus to flight is, of course, also present June, July and August. The decrease in the minimum temperature during September is not accompanied by a similar decrease in the temperature at which the bees fly as there is nothing to stimulate the bees to fly, and the rise in temperature required to caues the bees to fly is comparatively large. The maximum temperature and the temperature at which the bees cease to fly tend to follow each other very closely. The difference between the maximum temperature and the temperature at which flight activity ceases varies and depends upon how long the bees remain flying after the maximum temperature has been reached and this in its turn depends upon the quantity and concentration of the nectar and pollen available in the field at any given time.

6. Discussion

It appears that the temperature at which bees commence to fly depends upon many factors among which, minimum temperature, is one of the most important. The lowest temperature at which bees fly from year to year is definitely related to the lowest minimum temperature in that season. Bees can fly at temperature as low as 21°F. (screen recording) if the bees need this flight and if the other conditions of the environment are suitable for the bees to commence flying.

According to Vansell (1930) in U.S.A. the usual brood nest temperature lies near 95°F., although 100°F. is often reached in crowded hives even as early as the middle of March. During the broodless period from November to January the minimum temperature recorded within the cluster was 51°F. in an unpacked hive at a time when outside temperature was 26°F. This indicates that the temperature of that part of the hive occupied by the bees varies during the different seasons.

Temperature alone, however, does not determine whether the bees will fly. Flighting is unlikely to take place in cold and sunless conditions but is very likely in warm and sunny conditions. There is a wide range of conditions between these two extremes. Bees commence to fly at a wide range of temperatures, but they do not fly until there is a definite rise in temperature. It is not true to say that the bees will fly when the temperature reaches a certain level or stop flying when the temperature falls to a certain level. This rise in temperature varies from month to month.

Table I shows that the rise needed to stimulate the bees to fly when the temperature of the hive is low (November to February : broodless period) is less than the rise needed to stimulate them when the temperature of the hive is high (March, April and May : brood-rearing period). The necessary rise in temperature increases gradually until March and decreases again gradually during May and still more from June to August, which are regarded as the months of the honey flow.

During September owing to the lack of stimuli in the field (nectar and pollen grains) to attract the bees to fly, the extent of the difference between the temperature at which the bees started to fly and the minimum temperature (night temperature) has to increase in order to stimulate the bees to commence outdoor activity. This continues until the end of October when this difference decreases again as the bees usually face few days of fine weather and need cleansing flights which acts as stimulus to flight once there is any noticeable rise in the air temperature.

The fluctuations observed in the temperature at which bees start to fly from day to day and from month to month is due to the bees becoming acclimatised to the surrounding temperature during the non-active period.

According to Dunkan (1929) in U.S.A. the daily average temperature of the brood area shown a remarkable constancy ranging from 92.5-93.5°F.

He (1931 and 1931a) stated that when a colony is subjected to high or low external temperatures, the temperature in the central brood area reaches a point which is beyond the absolute control of the bees, but within certain limits they can lower or rise hive temperatures, aiming to reach the optimum level required for brood rearing. There is a remarkable correlation between average daily environmental temperature and the average daily temperature of the broodless area which drifts proportionally with the rise or fall of the external temperature. The unoccupied part of the hive according to Farrar (cited by Root, 1945) will be at the same temperature as that of the outside air. The bees will never fly until a noticeable rise in temperature is approached although the minimum temperature for the day may be higher than the temperature at which the bees commenced to fly during the preceding day.

Although bees will fly as at temperature as low as 21°F. it should be clearly understood that the temperature of their bodies during flight does not fall to such a low level, as in fact we know that if this were the case, the bees could not move. It appears that bees although maintaining the temperature of that part of the hive in which they are living, at, let us say a temperature of 51°F., are able to detect a very small rise in the outside temperature which raises the temperature of the unoccupied part of the hive also. According to Phillips (1945) bees can fly and maintain their body temperatures at outside temperatures approximating to the temperature necessary for life by taking muscular activity. If bees are blown to the ground during winter they often become chilled and die, but if they continue to fly and do not alight on the ground their bodies may maintain a temperature equal to the hive temperature, as the movement of their muscles produces heat which balances the loss of heat from the surface of their bodies.

During March and April, the appearance of a number of flowers begins to act as a stimulant to flight. The need for pollen for brood rearing increases and flight become more important than ever before. Under these changed circumstances it is found that the bees will stay longer outside the hive and the temperature at which bees cease flying for any given day becomes lower than the maximum temperature for the day.

The important relationship between the maximum temperature recorded during the day and the temperature at which the bees cease to fly indicates that the time of the maximum temperature is one of the limiting factors which determines the length of the flying period, and that bees continue to fly until the temperature has reached its maximum for the day, where upon they begin to return back to the hive.

During the honey flow period (June, July and August), the smaller the difference between the temperature at which bees commenced to fly and the minimum temperature for the day, also the greater the difference between the maximum temperature for the day and the temperature at which the bees cease to fly, the better the net gain in weight of a normal colony is likely to be.

The annual range of the maximum temperature and the temperature at which the bees cease to fly, also of the minimum temperature and the temperature at which the bees commenced to fly during 1945 and 1946 (to the end of September 1946) are approximately similar, which indicates that they act in the same way and shows the close relationship between them.

The statement of Lundie (1925) in U.S.A. and of Brittain et al (1933) in Canada that the temperature at which flight begins to slacken in the afternoon (2° to 16° F.) is higher than that at which flight begins in the morning, seems, in general, to be in full agreement with data obtained at Rothamsted.

II. HONEYBEE FLIGHT ACTIVITY DISTRIBUTION DURING THE VARIOUS MONTHS OF THE YEAR

1. Introduction and review of literature

In the present section it is proposed to study the monthly variations in the duration of daily flying activity. To enable one to make such a comparison of flight activity of bees some index of activity is essential. On those days when activity outside the hive was recorded, the number of hours during which flying occurred were determined, and the average for each month was tabulated. Similar months from 1927 to 1946 for the nineteen years were grouped together.

So far as is known, no previous worker has made an attempt to study the distribution of periods of honeybee flight during the different months of the year except in so far as some investigators have made a few records of this kind incidently when making other observations.

Hambleton (1925) in U.S.A. recorded that during May 1923 bees flew on the average about 12 hours each day, and that during September 1922 they only flew for about 11 hours each day.

Risga (1929) in Riga in an attempt to discover the percentage loss of flying bees during a rainy day reported that on July 7th 1929 when conditions were unfavourable for flight the bees flew for about 12.5 hours, whilst on another unfavourable day, 12th August 1929, the bees flew from 6.30 a.m. to 21.30 p.m. at total of 15 hours. The same author recorded about 15 hours of flight on June 17th 1929 which he regarded as a good flying day.

It seems that the only previous continued attempt to study the duration of the flight of honeybees was carried out by Bodenheimer and Ben-

Nerya (1937) in Palestine by timing the length of their period of flight two days every month from sunrise to sunset for one year. They determined the seasonal activity by counting the number of bees leaving the hive and used the monthly average as an index of activity.

Table III represents data extracted from Table II of Bodenheimer and Ben-Nerya. The data shows a gradual increase in the daily average of the number of hours flown from January till it reached its peak during July and August then tailed off till it reached December.

TABLE III

Average of two-days period of flying activity in Palestine for each month extracted from Bodenheimer *and* Ben-Nerya (1937)

MONTHS	January	February	March	April	May	June	July	August	September	October	November	December
Number of hours . . .	6	7.5	11.5	12	12.5	12.5	14	14	11.5	10	7.5	7

2. Rothamsted results

Weather conditions at Rothamsted differed greatly from month to month, some were favourable for flight and others were less favourable so that the bees only flew under those special conditions which has been discussed.

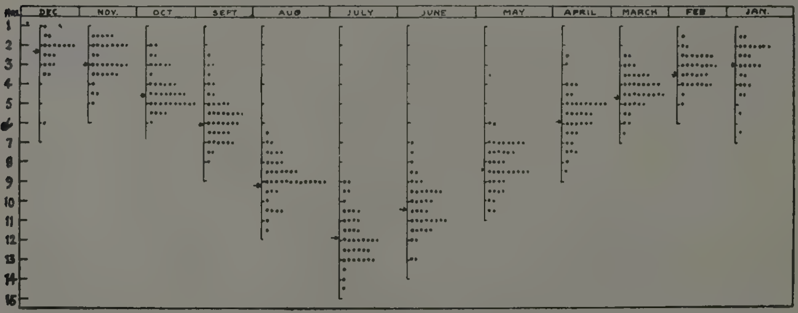

Fig. 4: Frequency distribution-hours of activities during various months of 19 years (1927-1946).

During January, February, November and December bees may fly in order to defecate. The presence of abundant nectar or pollen during the active season (May to August) will encourage the bees to fly and remain working in the field. The need of pollen and water tend to stimluate the bees to fly under comparatively unfavourable conditions during the early part of the brood rearing cycle (February to May).

The flying data for 19 years have been plotted in the form of frequency histograms in which the records obtained under months, are compared (Fig. 4).

The monthly mean of the average period of flight was obtained separately from records of the individual colony. The number of colonies used varies from year to year, so the figures referring to the average daily period of flight vary accordingly, e.g. in January 26 records of the average daily period of flight were taken whilst in June there were 41 records.

3. Frequency distribution of the monthly means

The frequency distribution of these monthly means is shown in Fig. 5. The mean of the means of the daily average period of flight was 6.02 hours,

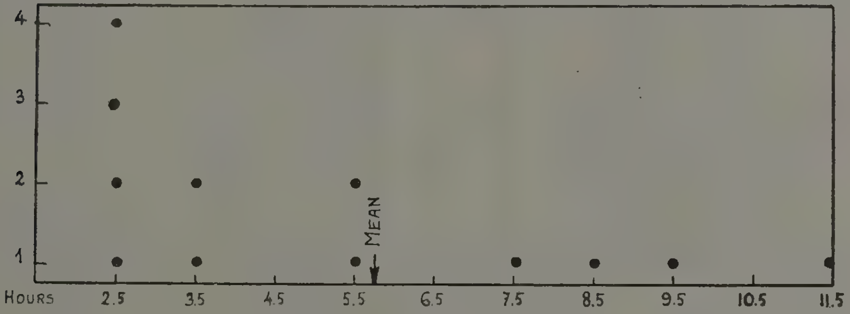

Fig. 5 : Frequency distribution of the monthly mean hours of bee flighting.

with a Standard Deviation of ± 3.04, but the model point was 3.32 hours. The shortest period of flight was recorded during December, 2.56 hours, and the longest period during July, 11.94 hours, giving a range of 9.38 hours.

4. Discussion

The honeybee does not hibernate, but during the winter the colony remains in a relatively quiescent state. Bees begin to cluster when the outside temperature falls to about 57°F. (Corkins, 1930). Should a rise in the external temperature occur it results in expansion of the cluster.

A noticeable rise in temperature renders flight possible. The February and March sun brings sign of new life in the apiary and as the temperature continues to rise, the bees are able to fly more frequently. The daily average period of flying increases gradually from January to July when it reaches its peak, and then tails off gradually until December comes (Fig. 6). Data for colony W.2 in 1945 and 1946 shown diagramatically in Fig. 7 based on weekly means, were in agreement with the general trend.

It is clear that observations made during different seasons, and sometimes even those made on another colony during the same season, are not always similar.

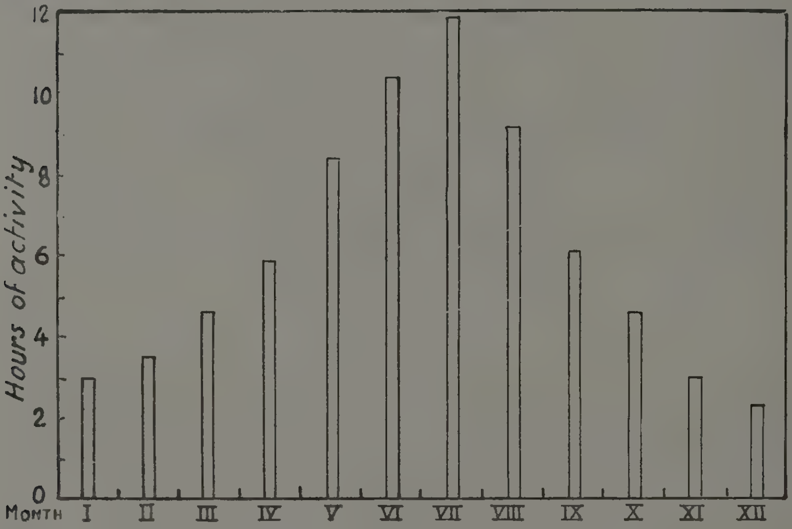

Fig. 6 : Mean hours of activity per day 19 years.

Records from nineteen successive years for each month of the year give us information about the length of time the honeybees stay out of the hive under favourable conditions. During January 1934 for instance bees from colony W.3 spent in the field an average of 2.3 hours daily, colony W.4 and colony W.5 on the other hand spent 4.2 and 1.7 hours respectively.

Variations from year to year are clearly due to the weather conditions. The colonies were however not all alike. Nearly all figures derived from records belonging to colony W.2 and colony W.5 from July 1945 to September 1946 were similar owing to the fact that these colonies were of equal strength throughout the period of investigation.

It is interesting to note that Hambleton's (1925) results seemed to show only a small difference in the duration of flight between spring and autumn, but this can be attributed to his method not being sufficiently sensitive. The figures given by Risga (1929) on two rainy days, one in July

(12.5 hours) and the other in August (12 hours), differ significantly from those for the day on which he recorded 15 hours flying time on June 17th 1929 a favourable day, and concluded that the number of bees leaving and returning back to the hive was greater on fine days than on rainy days. This shows that rain affects the magnitude of flying activity, and interferes with the duration of flight.

The data calculated from Bodenheimer and Ben-Nerya (1937) results for duration of flight based on two days each month appears to be insufficient to produce really useful information. Although the Palestine figures in Table III agreed very well with Rothamsted data plotted in Fig. 6, yet in such a comparatively warm region as Palestine the daily average length of the period of flight is much higher. The cold months in Palestine resemble the quiet season in England. The interesting point is that in Palestine during the peak of activity, the duration of the daily period of flight may reach 14 hours per day and in England up to 16 hours; the difference being due to the longer duration of daylight.

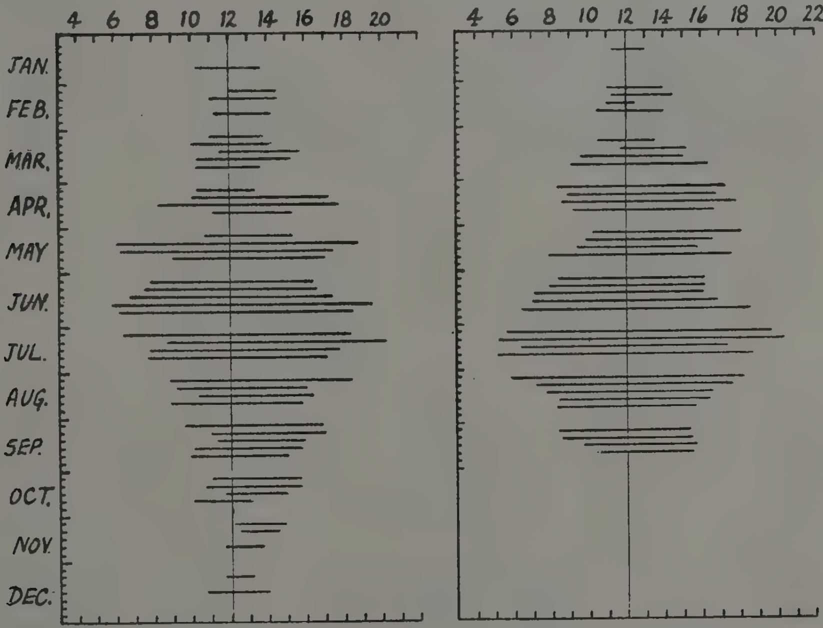

Fig. 7 : Weekly mean hours of activity in colony W. 2 (1945-1946)

From Fig. 4 it will be seen that the frequency distributions for each month of the nineteen years are generally approximately symmetrical, but in the months of December and January there is a tendency to a skew curve, which may be due to the omission of the years in which no activity was recorded in these months.

5. The significance of the monthly mean of the daily average period of flighting

Table IV shows monthly means, number of cases, standard deviation, standard error of the mean, lowest average recorded, highest average recorded, range, median, and mode of daily average hours of flight activity during the days where flight were recorded.

If we regard the means in Table IV as the normal hours of the average daily flying period, it will be seen that in December the lowest duration, 2.56±1.06 hours occurs and that in July the highest duration 11.94-1.27 hours was recorded. The annual range is, therefore, 9.38 hours.

TABLE IV

MONTH	MEAN IN HGURS	Numbers of cases	Standard deviation q	Standard error of mean $\sqrt{N}$	Lowers average recorded in hours	Highest average recorded in hours	RANGE	MEDIAN	MODE
January . .	3.15	26	± 1.25	± 0.24	1.6	6.5	4.9	3.00	2.70
February. .	3.34	33	± 0.83	± 0.16	1.5	5.3	3.8	3.10	2.62
March. . .	4.44	37	± 0.99	± 0.16	2.5	6.7	4.2	4.40	4.32
April . . .	5 80	38	± 1.29	± 0 21	2.9	8.6	5.7	5.65	5.35
May . . .	8.27	42	± 1.33	± 0.21	3.7	10.7	7.0	8.45	8.81
June . . .	10.43	41	± 1.35	± 0.21	7.3	13.1	5.8	10.60	10.94
July . . .	11.94	41	± 1.27	± 0.20	9.0	14.5	5.5	12.20	12.72
August . .	9.06	41	± 1.08	± 0.17	6.7	11.6	5.1	9.00	8.88
September .	5.87	42	± 1.24	± 0.19	2.7	8 2	5.5	6.05	6.41
October . .	4.42	39	± 1.04	± 0.17	2.1	6.2	4.1	4.60	4.96
November .	2.91	33	± 0.92	± 0.18	1.5	5.0	3.5	3.00	3.18
December .	2.56	19	± 1.06	± 0.24	1.0	6.0	5.0	2.10	1.18

In Table IV it will be seen that during the period under review, December shows the lowest daily average period of flight, one hour on December 1938 (colony W.2), and in July 1938 (colony W.4) the highest daily average period of flight 14.5 hours occurred.

The annual range of the lowest daily average period of flight is about 8 hours and for the highest average is 9.5 hours.

Figures referring to the medians are approximate the figures of the means and show that the distribution is practically symmetrical and the modes of the various months are also approximately equal to the medians except those during January and December.

The mean is larger than the median and the mode in January, February, April and December, equal to the median in March and August whilst the mode is larger than the mean and the median during May to November excluding August.

The real importance of the data lies in their answer to the question : are the deviations of the activity rates of the bees from the trend shown by the annual cycle associated with similar deviation in the loss or gain in the colony weight? This is already discussed in another paper (Wafa, 1954).

6. Significance of the difference between monthly means hours of flying activity

Table V shows quite clearly that there were a remarkable difference in flying activity during the various months of the year, except in two cases January-February and November-December when the difference was not quite significant. The differences between the other months were highly significant.

TABLE V

THE TWO OBSERVATIONAL MEANS	DIFFERENCES BETWEEN MEANS	t	P (estimated from Table IV, p. 169, Fisher, 1944)	REMARKS
February - January	0.19	0.7010	> 0.5 and < 0.4	Not significant
March - February	1.10	5.0025	< 0.01	Highly significant
April - March	1.36	5.1044	< 0.01	,, ,,
May - April, ...	2.47	6.1859	< 0.01	,, ,,
June - May	2.16	5.9163	< 0.01	,, ,,
July - June	1.51	5.1914	< 0.01	,, ,,
July - August . . . . . ,	2.88	10.9521	< 0.01	,, ,,
August - September	3.19	12.5563	< 0.01	,, ,,
September - October . . .	1.45	5.6820	< 0.01	,, ,,
October - November . . .	1.51	6.4597	< 0.01	,, ,,
November - December. . .	0.35	1.2461	> 0.2 and < 0.3	Significant

For purposes of interpretation, it appears convenient to divide the year into four seasons, viz. December to February as the quiet season from the point of view of flight. During this period whenever conditions are favourable bees will fly. During the second period, March-April, the bees are very active in the field; the colony is building up and preparing for the active season. Since the bees require nectar, water and pollen for brood rearing they have to work a long hours. During September-October which months follow the period of great activity, large numbers of bees are still present in the hives and great numbers await favourable opportunities to leave the hive in search of late flowers. The drones are killed off and the bees make ready for winter. The months of May to August together make up the really active season of the year yet in some years May and August may be quite unfavourable. The climax of activity is shared between June and July. Although the number of recorded hours of flying that comprise each one of these periods is uneven, the number of the mean daily average number hours of flight during which the bees have been at work in each of these periods does not vary so much.

III. CONCLUSION AND SUMMARY

This study was made in order to determine the effect of temperature on honeybee flighting and honeybee flighting distribution during the various months of the year, using daily records of colonies of bees kept on automatically weighing machines and of the temperature at which the bees commenced to and ceased to fly on each day that flighting occurred.

The system described and applied is fairly exact for determing the daily average length of the period of flight throughout the year and indirectly the seasonal variation.

Bees flew at temperature as low as 21°F. (screen recording) if the bees need this flight (in order to defaecate) and if the other conditions of the environment are suitable for the bees to commence flying.

Temperature alone does not determine whether the bees will fly. Flighting is unlikely to take place in cold and sunless conditions but is very likely in warm and sunny conditions.

Bees commence to fly at a wide range of temperatures which depend upon the minimum temperature (night temperature), and the bees rarely flew until there was a definite rise in temperature.

The rise needed to stimulate the bees to fly when the temperature inside the hive is low (November to February : broodless period) is less than the rise needed to stimulate them when the temperature inside the hive is high (March, April and May : brood-rearing period).

The necessary rise in temperature (Fig. 3) increases gradually until March and decreases again gradually during May and still more from June to August, which are regarded as the months of honeyflow under Rothamsted conditions.

When nectar flow was declining or had ended the rise in temperature necessary to stimulate flight was much greater than during the honeyflow.

During September owing to the lask of stimuli in the field (nectar and pollen grains) to attract the bees to fly, the extent of the difference between the temperature at which the bees started to fly and the minimum temperature (night temperature) has to increase in order to stimulate the bees to commence outdoor activity.

This continues until the end of October when this difference decreases again as the bees face few days of fine weather and need cleansing flights which acts as a stimulus to flight once there is any noticeable rise in the air temperature.

The fluctuations observed in the temperature at which bees started to fly from day to day and from month to month are due to the fluctuations of the air temperatures and to the bees becoming acclimatised to the surrounding temperature during the non-active period.

High significant positive correlations were found between the minimum temperature of the environment and the temperature at which the bees flew.

The bees usually ceased to fly after the outside temperature had reached its maximum for the day, and they occasionally remained in the field after the temperature had begun to fall.

The extent to which this happened differed markedly at different times of the year and was dependent upon the influence exerted by other factors of the environment.

Colonies of equal strength behave alike under similar environmental conditions so far as flighting is concerned (Colonies W.2 and W.5, 1945 and 1946).

The normal duration of periods of flight varies from 2.56 hours during December to 11.94 hours during July.

IV. ACKNOWLEDGMENTS

The writer wishes to express his sincere feeling of gratitude to Dr. C. B. Williams, Head of the Entomology Department at Rothamsted for his invaluable help and kind personal guidance and to Dr. C. G. Butler, Head of the Bee Department at Rothamsted for his wise council and unfailing encouragement throughout this work.

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Nachtrag zu meiner Arbeit "Eine neue *Orius* - Art aus Palaestina"

[Hemiptera-Heteroptera : Anthocoridae]

(*Bull. Soc. Fouad Ier Entom.*, XXXVIII, 1954, pp. 225-226)

von EDUARD WAGNER, Hamburg

In meiner obigen Arbeit ist bei der Beschreibung von *Orius luridus* m. auf Seite 225 ein bedauerlicher Druckfehler dadurch entstanden, dass eine Zeile des Manuskripts ausgelassen wurde. Es muss dort im 2. Absatz heissen :

Kopf (Fig. 1) deutlich kürzer als breit, gelb bis gelbbraun, an der Spitze heller, glänzend ; Scheitel beim ♂ 1,26×, beim ♀ 1,9× so breit wie das braune Auge....... (weiter wie l.c.).

In der Sammlung Puton im Museum National d'Histoire Naturelle in Paris fanden sich 2 ♀♀ dieser Art mit der Fundortangabe « Syria ». Sie tragen ausserdem ein Etikett mit mir unbekannter Handschrift : « *T. peregrinus* Reut., n. sp. ». Mir ist eine Art dieses Namens nicht bekannt und der Name *peregrinus* Reut. dürfte daher ein nomen nudum sein.

The effect of nutrition on the biology of *Tribolium confusum* Duv., *Tribolium castaneum* Hbst., and *Latheticus oryzae* Waterh.

[Coleoptera : Tenebrionidae]

(with 4 Text-Figures, and 7 Tables)

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INTRODUCTION

Food is undoubtedly a growth regulating factor. Chapman (1924) reared *Tribolim confusum* Duv. on various media and showed that the growth of the larvae is accelerated when fed on wheat embryo and much retarded when fed on polished-rice flour. Wheat embryo is notable for its content of Vitamine B, while polished rice flour is known to contain the smallest amount of it. Yeast, likewise, shortens the life-cycle of the Confused flour beetle ; but the shortest life-cycle with yeast is longer than that with wheat embryo (Sweetman and Palmer, 1928).

In the present work wheat, maize and rice were used as food materials, and their effect on the duration of the developmental stages, on the number of larval instars, on the rate of oviposition and on the population density of *Tribonium confusum* Duv., *T. castaneum* Hbst., and *Latheticus oryzae* Waterh., were studied.

Experimental insects of known age were kept either singly or in pairs in 40×17 mm. glass tubes containing food and their open ends were covered with gauze. Eggs were obtained from pairs of every species kept in such tubes by sifting the flour through a sieve of 58 mesh/inch. Food materials were exposed to 70° C. for two hours, and then placed in Petri dishes covered with pieces of muslin. They were kept under laboratory conditions, un-

Bull. Soc. Entom. Egypte, XXXIX, 1955 (337).

der which the work was carried out, for several weeks before use so as to come into equilibrium with the atmospheric humidity.

The effect of diet on the duration of developmental stages

Two experiments were undertaken to find out the effect of different food materials on the duration of developmental stages. The first experiment was carried out on *T. castaneum ;* whole-flour meal and crushed grains of both wheat and maize were used as food. The experiment started on September 1951 and ended on October 20th. During this period the room temperature ranged between 30 and 25.8° C. with an average of 27.3° C., and the relative humidity between 60 and 65%, with an average of 62.0%.

The second experiment was carried out on *T. castaneum, T. confusum* and *Latheticus oryzae.* Sieved wheat flour, wheat bran and polished rice flour were used as food. The first two diets were obtained from whole-wheat flour by using a sieve of 58 mesh/inch. The effect of these diets was compared with a control series of larvae kept on whole-flour meal of wheat and maize. The experiment started on June 1st., 1952 and ended on September 1st. During this period the room temperature ranged between 26 and 31° C, with an average of 29.2° C., and the relative humidity between 44.3 and 71.3%, with an average of 59.9%.

Results

Table I shows the results of the first experiment. It can be observed that the duration of the larval stages of *T. castaneum* is shorter on whole-wheat and whole-maize flour than on crushed grains ; the difference is statistically significant at 0.05 level of probability ($P = < 0.001$). It is also clear

TABLE I

DIET		DURATION IN DAYS		
		LARVAL STAGE	PUPAL STAGE	PERIOD FROM EGG TO ADULT
Whole-wheat flour . .	Mean . . .	21.4 ± 0.29	7.7	32.7 ± 0.23
	Range . .	18-26	6-9	30-37
	Number reached maturity			45
Whole-maize flour . .	Mean . . .	23.8 ± 0 51	7.9	35.5 ± 0.54
	Range . .	19-34	7-10	32-48
	Number reached maturity			44
Wheat crushed grains .	Mean . . .	26.2 ± 0.54	7.7	37.6 ± 0.59
	Range. . .	20-31	7-10	32-43
	Number reached maturity			27
Maize crushed grains .	Mean . . .	32.3 ± 1.24	9.3	45.2 ± 1.51
	Range. . .	21-50	6-16	33-69
	Number reached maturity			29

Numbers of larvae at the beginning of the experiment were 47, 46, 39 and 42 respectively.

that development takes a shorter time on whole-meal flour and crushed grains of wheat than on maize ; the difference between whole-meal flour of wheat and maize or between crushed grains of wheat and maize is statistically significant ($P = < 0.001$). Crushed grains of wheat and maize gave a higher mortality rate than whole-meal flour ; the percentage of mortality was 30.8 in case of crushed grains of wheat and maize and 4.2 in whole-flour meal of the same. Crushed grains could not be easily consumed and most of the dead larvae were in the first or the second instar.

Table II shows the results of the second experiment. In *T. castaneum* the larval period on polished-rice flour is relatively longer than on whole-meal flour of both wheat and maize ; the difference in both cases is statistically significant ($P = < 0.001$). On wheat bran the larval period is shorter than on whole-flour of wheat and maize. The difference between wheat bran and whole-wheat flour is slightly significant ($P = < 0.05$) ; but the difference between wheat bran and whole-maize flour is highly significant ($P = < 0.001$). There is no significant difference between sieved flour and

TABLE II

DIET	MEAN DURATION IN DAYS			
	Tribolium castaneum			
	No. used	Larvae	Pupae	Egg-Adult
Whole-wheat flour . .	51	22.5±0.23	6.3	33.4±0.21
Whole-maize flour . .	45	24.6±0.33	6.2	35.5±0.36
Sieved wheat flour . .	30	22.2±0.29	6.3	33.1±0.28
Wheat bran.	30	21.6±0.37	6.4	32.6±0.35
Polished rice flour . .	27	29.0±0.46	6.1	39.8±0.43
	Tribolium confusum			
Whole-wheat flour . .	35	25 3±0.22	6.7	38.4±0.22
Whole maize flour . .	30	27.8±0.25	6.5	40.7±0.31
Sieved wheat flour. .	30	25.8±0.42	6.6	38.9±0.27
Wheat bran	26	24.6±0.30	6.7	37.9±0.32
Polished rice flour. .	23	32.8±0.72	6.4	45.4±0.64
	Latheticus oryzae			
Whole-wheat flour . .	30	29.3±0.58	5.4	41.5±0.56
Whole-maize flour . .	11	56 7±3.07	5.0	68.4±3.14
Sieved wheat flour . .	23	26.2±0.62	5.6	38.6±0.56
Wheat bran	26	27.6±0.51	5.5	39.9±0.52
Polished rice flour. .	25	36.2±0.66	5.2	48.1±0.65

whole-flour of wheat ($P = > 0.30$); but there is a significant difference between sieved wheat-flour and whole-maize flour ($P = < 0.001$). Moreover, there is no significant difference between wheat bran and sieved wheat-flour ($P = > 0.10$).

In *T. confusum* similar results were obtained. The larval period is longer on polished-rice flour than on whole-meal flour of both wheat and maize: the difference in both cases is statistically significant ($P = < 0.001$). On wheat-bran, whole-wheat flour and whole-maize flour the larval periods were 24.6, 25.3 and 27.8 days respectively. The difference between wheat-bran and whole-wheat flour is statistically insignificant ($P = > 0.05$), but there is a significant difference between wheat bran and whole-maize flour ($P = < 0.001$). On sieved wheat flour the larval period was 25.8 days, the difference between this and whole-wheat flour is not significant ($P = > 0.20$); but there is a significant difference between sieved-wheat flour and whole-maize flour ($P = < 0.001$). The larval period is also shorter on wheat-bran than on sieved-wheat flour (24.6 and 25.8 days respectively): the difference is significant ($P = < 0.02$).

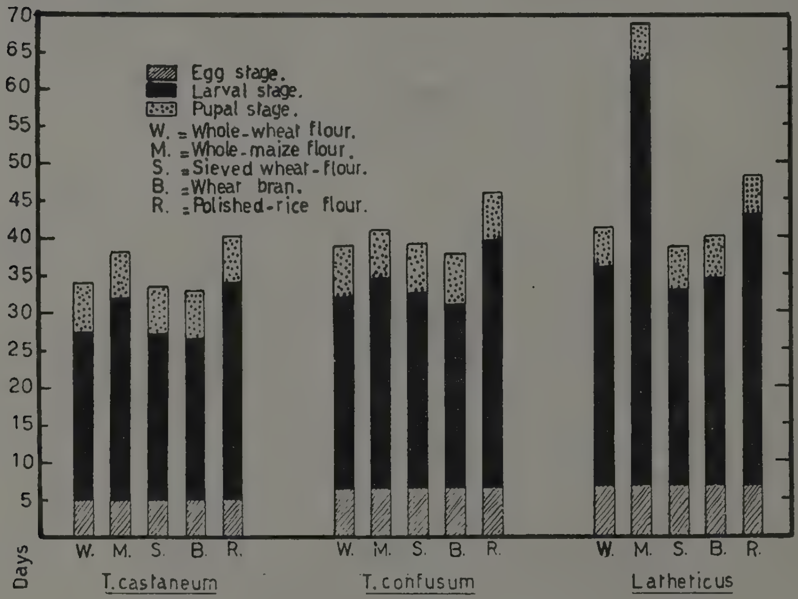

Fig. 1: Effect of diet on the developmental stages (June 1952).

In *Latheticus oryzae* it was found that when whole-maize flour was offered a great number of larvae failed to complete their development and were unable to get rid of their moults ; and this was accompanied by a high rate of mortality. Out of 40 larvae kept on maize flour eleven completed their development and gave rise to adults (mortality 72.5%). These passed through a prolonged larval period, i.e. 56.7 days, as compared with 29.3 and 36.2 days on whole-wheat flour and polished-rice flour respectively. The difference between whole-maize flour and whole-wheat flour, between whole-maize flour and polished-rice flour, and between whole-wheat flour and polished-rice flour is statistically significant ($P = < 0.001$). It was also found that the larval period was shorter on sieved-wheat flour than on whole-wheat flour, i.e. 26.2 and 29.3 days respectively ; the difference is significant ($P = < 0.01$). But the difference between whole-wheat flour and wheat-bran is slightly significant ($P = < 0.05$), and there is no significant difference between sieved flour of wheat and wheat bran ($P = > 0.05$).

Figure 1 is a histogram representing the effect of diet on the duration of the period from egg to adult in *T. confusum, T. castaneum* and *Latheticus oryzae*. It is clear that the change in the length of this period is largely due to the varying rate of growth of the larvae on the different diets.

The effect of diet on the number of larval instars

Food has a profound effect on the number of larval instars in many insects. Inadequate supply of food retards development and the frequency of moulting is correlated with the slow of growth (Wigglesworth, 1950). This is applicable to many insects especially those living in dry foodstuffs.

In the above mentioned experiments the number of larval instars was considered. The data of the first experiment are recorded in Table III. It can be seen that crushed grains of both wheat and maize increase the number of larval instars. 85.2 and 72.4% of the larvae underwent seven instars

TABLE III

DIET	NUMBER OF INDIVIDUALS HAVING							
	5 instars	Percentage	6 instars	Percentage	7 instars	Percentage	8 instars	Percentage
Whole-wheat flour	2	4.4	39	86.7	4	8.9	—	—
Whole-maize flour	—	—	32	72.7	11	25	1	2.3
Wheat crushed grains	—	—	4	14.8	23	85.2	—	—
Maize crushed grains	—	—	5	17.3	21	72.4	3	10.3

Table IV

Diet		Number and percentage of larvae having																		Total number of larvae
		5 instars	Percentage	6 instars	Percentage	7 instars	Percentage	8 instars	Percentage	9 instars	Percentage	10 instars	Percentage	11 instars	Percentage	12 instars	Percentage	14 instars	Percentage	
Whole-wheat flour	*Tribolium castaneum*	1	1.96	27	52.92	23	45.12													51
	Tribotium confusum			1	2.86	34	97.14													35
	Latheticus oryzae			5	16.65	21	69.93	4	13.42											30
Whole-maize flour	*Tribolium castaneum*			18	40.06	26	57.72	1	2.22											45
	Tribolium confusum					29	96.67	1	3.33											30
	Latheticus oryzae									1	9.09	6	54.64	2	18.18	1	9.09	1	9.09	11
Sieved wheat flour	*Tribolium castaneum*			20	66.70	10	33.3													30
	Tribolium confusum			1	3·33	27	90.01	2	6.66											30
	Latheticus oryzae			11	47.82	12	52.18													23
Wheat bran . . .	*Tribolium castaneum*			23	76.69	7	23.31													30
	Tribolium confusum					26	100.00													26
	Latheticus oryzae			7	26.95	19	73.05													26
Polished rice flour	*Tribotium castaneum*			1	3.71	21	77.74	5	18.55											27
	Tribolium confusum					7	30.45	13	56.50	3	13.05									23
	Latheticus oryzae					13	52.00	12	48.00											25

when kept on crushed grains of wheat and maize respectively. But 86.7 and 72.7% of the larvae underwent six instars when kept on whole-meal flour of wheat and maize respectively. The percentage of the larvae underwent seven instars on whole-maize flour is greater than the corresponding larvae on whole-wheat flour. This is in accordance with the above mentioned fact that the duration of the larval stage is much longer on maize than on wheat flour.

In the second experiment, Table IV, it appears that most of the larvae of *T. castaneum* (52.92, 66.70 and 76.69%) underwent six instars when whole-meal flour, sieved flour of wheat and wheat bran were used respectively. On the other hand most of the larvae (57.72%) underwent seven instars when whole-maize flour was used, and almost all larvae underwent seven or eight instars on polished-rice flour ; only one among 27 larvae had six instars.

In *T. confusum* it appears that with the exception of polished-rice flour most of the larvae had seven instars. Polished-rice flour had a different effect, 56.5% of the larvae had eight instars while 30.45% had seven ; and since all conditions were exactly the same it is evident that this food material must have had a different nutritive effect to other materials used.

In *Latheticus oryzae* it was found that most of the larvae underwent seven instars when whole-meal flour, sieved-flour of wheat, wheat bran and polished-rice flour were used. On whole-maized flour the few number of larvae which were able to survive (11 out of 40) underwent a varying number of instars, 9-14. A very slight change in the size of the larvae was observed after each moult.

The conclusions which can be drawn from these observations are that : (1) the duration of the larval stage of *T. confusum, T. castaneum* and *Latheticus oryzae* is much longer on whole-maize flour and polished-rice flour than on any other diet, and subsequently these diets have an increasing effect on the number of larval instars ; (2) whole-maize flour has a very low nutritive value for *Latheticus oryzae ;* only 27.5% of the larvae reached the adult stage.

The effect of diet on the rate of oviposition

The egg-laying behaviour of *T. castaneum, T. confusum* and *Latheticus oryzae* was studied during the first month of life on three different diets. Three groups of every species and every group contained five pairs of insects were used. Insects of every group were raised and kept when adults on the same diet. Whole-wheat flour, whole-maize flour and polished-rice flour were used. Insects were taken from the main cultures on 14th July, 1952, which marked the date of emergence for all individuals. Every pair (male and female) was isolated in a tube covered with muslin and provided with sufficient quantity of food. Fresh flour was supplied every day and daily egg-count was recorded. During the thirty days of the experiment room temperature ranged between 29.3 and 31°C, with an average of 29.9°C, and the relative humidity ranged between 54.7 and 65% with an average of 59.7%. The results are summarized in Table V, and graphically represented in Fig. 2.

TABLE V

DIET	NUMBER OF REFERENCE	*Tribolium castaneum*		*Tribolium confusum*		*Latheticus oryzae*	
		NUMBER OF EGGS LAID	MEAN	NUMBER OF EGGS LAID	MEAN	NUMBER OF EGGS LAID	MEAN
Whole-wheat flour	1	372	298.20 ± 24.63	389	330.80 ± 19.01	231	206.60 ± 16.69
	2	339		341		231	
	3	306		340		229	
	4	253		327		208	
	5	221		257		134	
Whole-maize flour	1	237	169.60 ± 16.77	258	207.80 ± 17.25	164	140.00 ± 7.06
	2	183		251		152	
	3	152		183		136	
	4	139		180		125	
	5	137		167		123	
Polished rice flour	1	74	47.40 ± 7.70	115	67.80 ± 13.91	53	32.80 ± 5.67
	2	56		91		37	
	3	47		56		34	
	4	37		49		25	
	5	23		28		15	

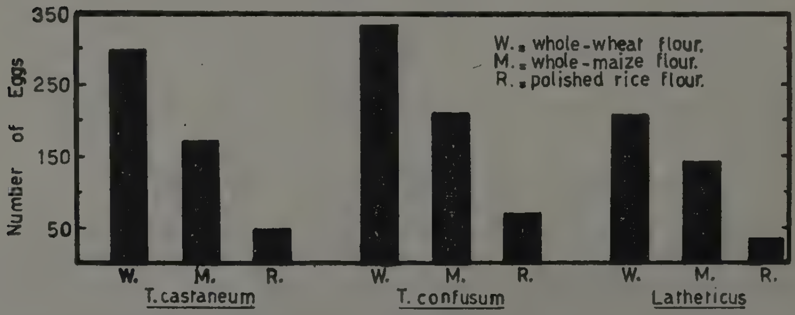

Fig. 2 : Effect of diet on the number of eggs laid during the first month of life.

The average numbers of eggs laid by *T. castaneum* during the experimental period were 298.2, 169.6 and 47.4 eggs for insects reared and fed on whole-wheat flour, whole-maize flour and polished-rice flour respectively. In *T. confusum* the means were much higher : 330.8, 207.8 and 67.8 eggs on the corresponding diets. Those of *Latheticus* were much less : 206.6, 140.0 and 32.8 eggs respectively. These results indicate that the fecundity of insects reared and fed on whole-wheat flour is much higher than that of insects kept on other diets ; whereas insects kept on polished-rice flour showed the least fecudity.

The effect of diet on the population density

Two experiments were undertaken to study the growth of the population on different diets. The first experiment was carried out on *T. castaneum* and *Latheticus oryzae ;* it lasted for two months, started on August 15th. 1951, and ended on October 15th. During this period the room temperature ranged between 31 and 28° C., with an average of 28.7° C., and the relative humidity between 65 and 55%, with an average of 61.8%. Eight one-pound jam jars were used for each species, every jar contained 100 gms of food and provided with ten pairs of newly emerged insects, 15-19 days old. Wheat, maize and rice were offered ; the first two diets as whole-flour meal, crushed and intact grains. Rice was supplied in the form of polished and unpolished grains. At the end of the experiment counts of all stages were made and data are recorded in Table VI.

TABLE VI

	SPECIES, STAGES.	WHEAT			MAIZE			RICE	
		Whole-flour	Crushed grains	Intact grains	Whole-flour	Crushed grains	Intact grains	Polished	Unpolished
Tribolium castaneum	Eggs								
	Larvae	6			26	1			
	Prepupae	15			18	1		1	
	Pupae	97	3		83	2		2	
	Adults	292	51		95	21		20	
	TOTAL NUMBER	410	54		222	25		23	
Latheticus oryzae	Eggs								
	Larvae	333*			109**				
	Prepupae	1							
	Pupae	2							
	Adults	20	20		20	20		9	
	TOTAL NUMBER	356	20		129	20		9	

* 158 larvae 5-6 mm long. 78 larvae 4 5 mm. long. 54 larvae 3-4 mm. long, and 43 larvae less than 3 mm. long.

** Most of the larvae were small ones, only 15 larvae were about 3 mm. long.

All adults of both species died when offered intact grains, but it was observed that some *Tribolium* beetles were able to feed on the embryos of very few number of wheat grains. They did not inflict any damage to maize. *Latheticus* beetles fail to attack intact grains at all. Figure 3 shows the mortality rate, and it can be observed that *Tribolium* beetles survived over a much longer period than *Latheticus*.

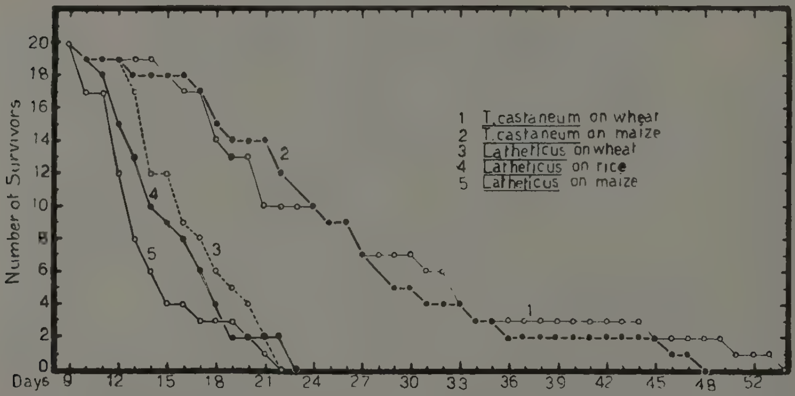

Fig. 3 : Mortality rate of *T. castaneum* and *Latheticus oryzae* kept on sound grains (August 1951).

The population obtained on whole-wheat flour was much higher than that on whole-maize flour. Moreover, development was much rapid on whole-wheat than on whole-maize flour ; the numbers of *Tribolium* beetles that reached maturity were 292 and 95 respectively. None of *Latheticus* offspring reached maturity, most of them were still in the larval stage, but those fed whole-wheat flour were much larger than those fed whole-maize flour. When crushed grains of wheat and maize were offered *Latheticus* laid no eggs, and when some of the females were dissected the ovaries were found to contain no ripe eggs. In *Tribolium* and on crushed grains reproduction was slightly higher on wheat than on maize, the total numbers of insects were 54 and 25 respectively. On unpolished rice adults of both species were found dead. But on polished rice *Tribolium* beetles were able to lay very few eggs. *Latheticus* beetles did not lay eggs at all, nine adults survived and eleven were found dead.

The second experiment was carried out on *T. confusum*, *T. castaneum* and *Latheticus oryzae*. Polished-rice flour and wheat bran were used, and their effect was compared with that of whole-wheat and whole-maize flour. Twelve jars were used and every one contained ten pairs of newly emerged insects and 200 gms. of food. The experiment lasted for two months, it started on July 6th, 1952, and ended on September 6th. During this period the room temperature ranged between 27.3 and 31° C., with an average of 29.2° C., and the relative humidity between 54.7 and 77.7%, with an average of 64.9%. At the end of the experiment counts of all stages were made ; data are recorded in Table VII, and graphically represented in Fig. 4.

TABLE VII

SPECIES,	STAGES.	Whole-wheat flour	Whole-maize flour	Wheat bran	Polished rice-flour
Tribolium castaneum	Eggs + larvae . .	184	234	220	123
	Prepupae	9	8	20	3
	Pupae	4	16	52	9
	Adults	416	266	408	26
	TOTAL NUMBER	613	524	700	161
Tribolium confusum	Eggs + larvae . .	220	157	341	142
	Prepupae	15	9	31	7
	Pupae	43	39	74	6
	Adults	1014	652	891	34
	TOTAL NUMBER	1292	857	1337	189
Latheticus oryzae	Eggs + larvae . .	179*	93**	371	81
	Prepupae	22		27	3
	Pupae	42		18	8
	Adults	53	20	27	25
	TOTAL NUMBER	296	113	443	117

* Most of larvae were more than 5 mm. long, only 13 larvae were less.

** Most of larvae were not more than 3 mm. long, very few larvae were more than 3 mm.

Judging by the number of insects that reached maturity bran was as effective as whole-flour of wheat. This was found in *T. castaneum* where 408 and 416 adults were found on these diets respectively. But the growth of population on bran was faster than on any other food material, it attained the highest level in all cases. Polished-rice flour gave the lowest level of population density in *T. confusum* and *T. castaneum*. In *Latheticus* the growth of population on polished-rice flour approximated that on whole-maize flour, the total numbers of individuals were 117 and 113 respectively. But the growth of population on whole-wheat flour and bran was much higher. On maize the growth of *Latheticus* population proceeded very slowly. At the end of the experiment, it was found that none of the offspring had reached maturity.

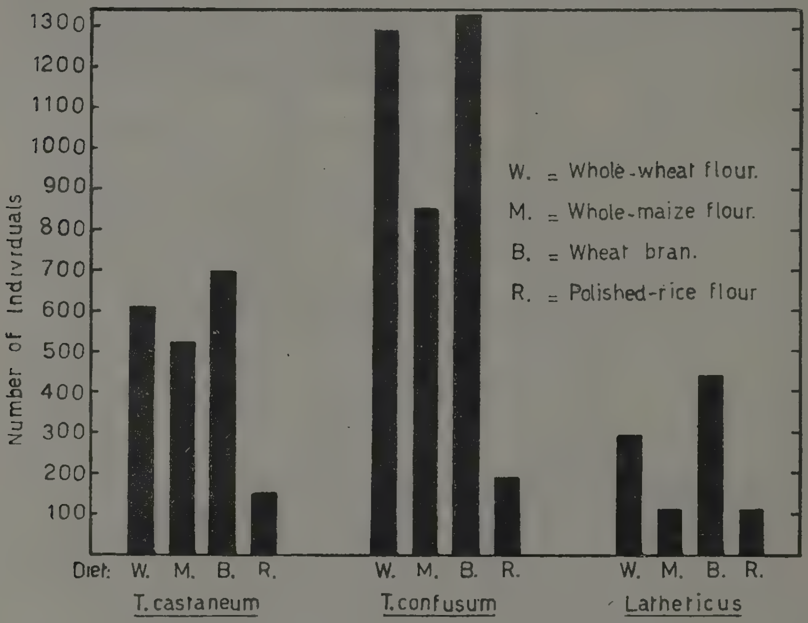

Fig. 4 : Effect of diet on the population density.

SUMMARY

1. Larval development takes a shorter time on whole flour of wheat and maize than on crushed grains. On wheat-bran the larval period of *T. castaneum* and *T. confusum* seems to be shorter than on whole-meal flour of wheat and maize, but on polished-rice flour it is much longer.

2. Whole-meal flour and sieved-flour of wheat seem to have a similar effect on larval development and they are both more efficient than whole-maize flour.

3. *Latheticus oryzae* differs from *T. confusum* and *T. castaneum* in that : mortality among the larvae was very high when whole-maize flour was used ; and in that polished-rice flour is more efficient than whole-maize flour ; the duration of the larval stage on sieved-wheat flour was shorter than on whole-wheat flour.

4. The number of larval instars is very much associated with the duration

of the larval stage. Crushed grains, whole-maize flour and polished-rice flour lengthen the larval period and subsequently increase the number of instars.

5. Insects reared on whole-wheat flour showed the highest fecundity, but those reared on polished-rice flour showed the lowest. Under the same conditions the average number of eggs laid by *T. confusum* was generally much higher than that of *T. castaneum*, that of *Latheticus* was the lowest.

6. The growth of population on wheat-bran was faster than on any other food material used. In *T. confusum* and *T. castaneum* polished-rice flour gave the lowest level of population density, but in *Latheticus* it was the whole-maize flour.

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Biological studies on *Tribolium confusum* Duv., *Tribolium castaneum* Hbst., and *Latheticus oryzae* Waterh.

[Coleoptera : Tenebrionidae]

(with 7 Text-Figures, and 4 Tables)

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INTRODUCTION

Flour and other cereal products are subject to attack by a large number of beetles belonging to the Tenebrionidae. Of these, the most abundant and attractive are the rust-red flour beetle, *Tribolium castaneum*, the confused flour beetle, *Tribolium confusum*, and the long-headed flour beetle, *Latheticus oryzae*. *T. castaneum* and *T. confusum* are known to be cosmopolitan, occurring in flour-mills, granaries and wherever grain is stored. Good (1933) states that *T. castaneum* is essentially an insect of warm climate, being seldom taken north of the fortieth parallel, while *T. confusum* seems to prefer cooler climates. According to Willcocks (1925), *T. castaneum* is the more common species in Egypt.

These insects, although unable to attack sound grains, yet they are found in great numbers, and cause serious losses and considerable damage to flour and grains that have been previously attacked by other pests. In case of severe infestation flour or other materials invaded may have a characteristic pungent odour as a result of the gaseous secretion exuded by the beetles. Such flour has an exceedingly low viscosity and its elasticity is markedly affected ; it may cause gastric disturbance if used as food (Payne, 1925).

Bull. Soc. Entom. Egypte, XXXIX, 1955 (351).

The long-headed flour beetle, *Latheticus oryzae,* has a somewhat higher optimum temperature range than that of the two species of *Tribolium.* Oxley (1948) stated that *Latheticus* is particularly well adapted to life in grain which has been caused to heat by the activities of other insects. It is unusually tolerant to high temperatures and higher carbon dioxide concentrations, so that it is able to maintain heat production in conditions which might be fatal to most of the « primary » grain pests. It is the aim of this paper to give a comparative study on the biology of the three pests mentioned above under the room temperature and relative humidity. This study covers the duration of the different stages throughout the year, number of generations and seasonal life-history.

Material and methods

Insects used in this work were originally obtained from flour-mills. Cultures were maintained in 1 lb. jam-jars covered with pieces of muslin and kept under laboratory conditions. From these cultures insects of known age and sex were obtainable. All experimental insects were kept either singly or in pairs in 40×17 mm. glass tubes containing food, and their open ends were covered with gauze. Eggs were obtained from five pairs of every species by sifting the flour through a sieve of 58 mesh/inch. The eggs laid on every day of the first week of every month were kept for biological study. Those of one day of all five pairs of every species were placed together in a glass tube and examined daily. In order to ascertain the number of larval instars, their duration, and the duration of the pupal stage, larvae were placed singly in a glass-tube soon after hatching. They were provided with sufficient food which was regularly renewed every two or three days. Sex was determined in the pupal stage following the method of Park (1934).

Whole-wheat flour was used as food. It was first sterilized by exposure to 60-70° C. for two hours. Flour was placed in Petri dishes covered with pieces of muslin and kept under laboratory conditions before use for several weeks so as to come into equilibrium with the atmospheric humidity.

The work has been carried out under room temperature and relative humidity. Records were taken three times a day : at the early morning at 8 a.m., in the afternoon at 2 p.m., and in the evening at 8 p.m. Hartzell (after Chapman, 1931) points out that a good approximation for the daily mean temperature may be arrived at by dividing the sum of the hourly temperature by 24. He also states that the common method for computing the mean temperature for the day by dividing the sum of the maximum and minimum temperatures by two is far from being accurate as the maximum and minimum temperatures are usually attained for only a short period of time, and thus it may be misleading. As the method suggested by Hartzell is not practicable under the prevailing conditions, it was found that records of temperature and relative humidity obtained at the above mentioned times of the day would give a satisfactory approximation of room conditions.

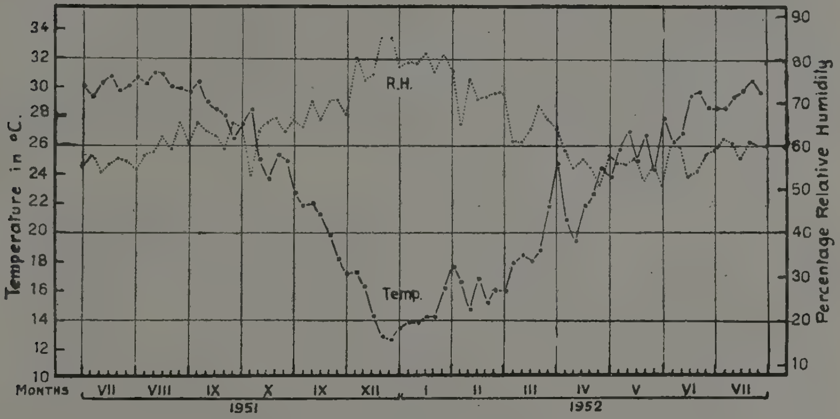

Fig. 1: Temperature and relative humidity at 5-day intervals.

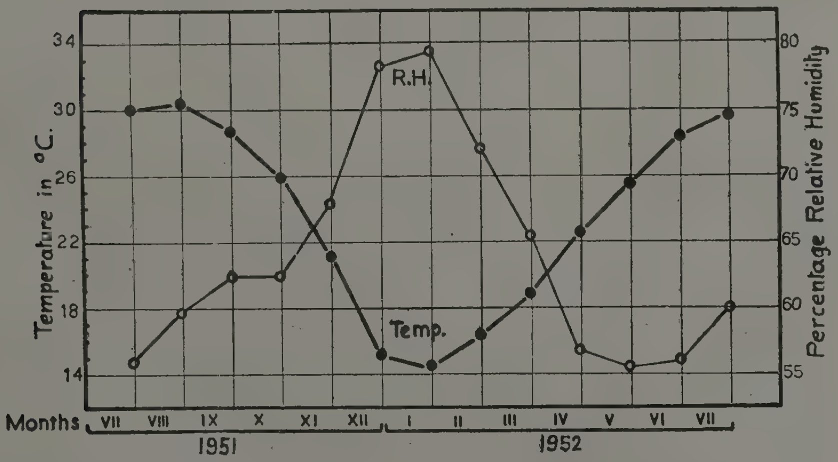

Fig 2: Temperature and relative humidity during the months of the year 1951-1952.

Figure 1, represents the temperature and relative humidity at 5-day intervals and Figure 2, represents the average monthly temperature and relative humidity throughout the experimental period.

Duration of the different stages throughout the year

The incubation period

References with regard to the incubation period of eggs of both species of *Tribolium* are numerous. But in most cases controlled conditions of temperature and relative humidity were used. The daily fluctuation of temperature has in many cases quite a different effect to those constant conditions used by many authors. As for *Latheticus oryzae* little is known as far as the incubation period is concerned.

Holdaway in his studies on the development of *T. confusum* at various relative humidities (ranging from nearly zero to about 100%) and under a constant temperature of about 27° C. found that the eggs as well as the pupae were of almost exactly the same duration throughout the entire scale of relative humidity (after Chapman, 1931). Brindley (1930) gave an average period of 5.5 days for the eggs of *T. confusum* at 30° C. and 73% relative humidity. Patton (1930) stated that the incubation period of *T. confusum* ranges between 6 and 10 days depending on temperature, and that *T. castaneum* is similar to *T. confusum* in almost all respects. Good (1933) gave the average periods of 5.5 days and 6.8 days for the eggs of *T. castaneum* and *T. confusum* respectively at 27° C., humidity not controlled. He also mentioned that at an average temperature of 21° C. and a relative humidity of about 34% the incubation periods were 8.6 and 12.8 days for both species respectively. Besides, he stated that continuous light slightly accelerated development. Nagel and Shepard (1934) in their observations on the lethal effect of low temperatures on the various stages of *T. confusum* found that in order to obtain 100% mortality in the egg stage at temperatures of : 7, 0, -6, -12 and -18° C., the eggs required 432, 16, 14, 14 and 1 hours respectively. Good (1936) reported that eggs of *T. castaneum* failed to hatch when placed out of doors at a temperature slightly above freezing point or at 35° C. He also stated that 30° C. seems to be close to the optimum incubation temperature: a lot of 137 eggs kept at this temperature hatched in 3-5 days with an average of 4 days. Stanley (1939) determined the time required for the development of *Tribolium* eggs and gave the mean value of 6.2 days at 27° C. and 75% R.H.

The data shown in Table I and Figure 3 give the mean incubation periods for the eggs of *T. castaneum, T. confusum* and *Latheticus oryzae* under laboratory conditions throughout the year. A study of these data shows clearly that the incubation period of *T. castaneum* seems to be slightly shorter than that of *T. confusum,* the difference is statistically significant at 0.05 level of probability ($P = < 0.001$ in all months save April when it is < 0.01).

This agrees with the results obtained by Good (1933 and 1936). It is also obvious that the incubation period is shortened with the rise of temperature.

During the period from about 15th November 1951 till the middle of March 1952 in case of *Tribolium* beetles, and from late October 1951 till nearly April 1952 in case of *Latheticus* no eggs were laid. During December 1951, January and February 1952, however, eggs were obtained from individuals when kept in an incubator running at 28° C. They were subjected afterwards to laboratory conditions where the mean temperatures were 15, 14.5 and 16° C. respectively, and it was found that they all failed to hatch. It seems justifiable to conclude, therefore, that hatching does not occur below a temperature of about 16° C. in case of both *Tribolium* and *Latheticus*. Butler (1949) states that the threshold of embryonic development is about 15° C. in *T. confusum* and probably a little higher, about 17° C. in *T. castaneum*.

TABLE I

The incubation period of the eggs
of Tribolium castaneum, Tribolium confusum, *and* Latheticus oryzae
throughout the year (*in days*)

MONTHS		*Tribolium castaneum*			*Tribolium confusum*			*Latheticus oryzae*		
		Mean incubation period	Range	Number of eggs used	Mean incubation period	Range	Number of eggs used	Mean incubation period	Range	Number of eggs used
July	1951	3.5±0.05	3-4	97	4.9±0.04	4-6	56	4.8±0.05	4-5	63
August	,,	3.7±0.04	3-4	105	4.9±0.04	4-5	54	4.4±0.06	4-5	66
September	,,	3.7±0.03	3-5	185	5.3±0.06	5 6	61	4.6±0.06	4 6	64
October	,,	4.5±0 06	4-5	77	5.6±0.07	5-6	52	5.7±0.04	5-6	118
November	,,	11.0±0.10	9-12	54	13.6±0.14	12-15	32			
March	1952*	7.7±0.11	6-10	88	9.3±0.14	8-12	83			
April	,,	12.2±0.26	6-13	164	13.1±0.15	8-15	140	17.9±0.28	14-20	25
April	,,							10 2±0.10	9-12	58**
May	,,	5.6±0.05	4-7	216	7.1±0.05	6-8	149	7.7±0.08	6-9	95
June	,,	4 8±0.03	4-6	239	6.5±0.04	6-7	166	6.7±0.03	5-7	165

* This batch of eggs was taken at the end of the month, from 23rd to 30th the March 1952.

** This batch of eggs was taken in the second half of the month.

Records on the hatching of several hundreds of eggs show that approximately 80-95% of the eggs laid by *T. confusum* and *T. castaneum* and 75-95% of those laid by *Latheticus* hatched. But in a batch of *Latheticus* eggs taken at the beginning of April 1952 the viability of eggs was found to be 50%.

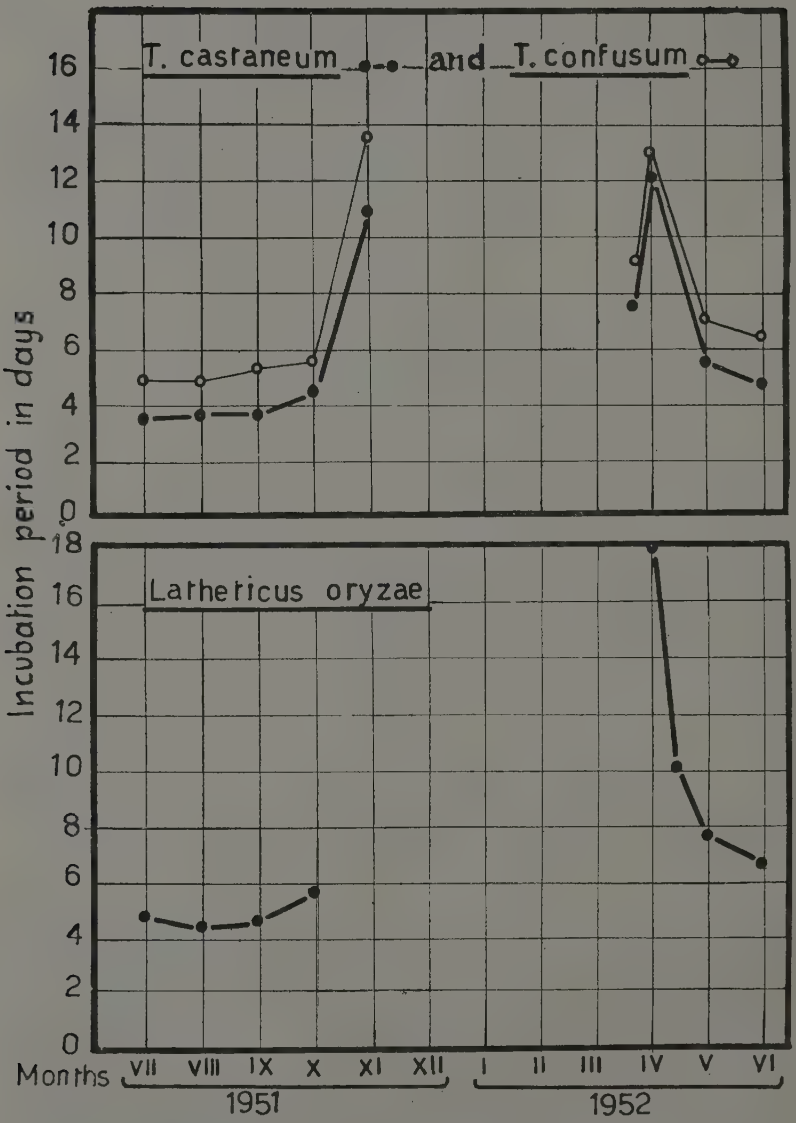

Fig. 3: The incubation period of *T. castaneum*, *T. confusum*, and *Latheticus oryzae* throughout the year.

This corresponds to a spell of cold weather at that time of that year as indicated in Figure 1. Cold weather increased the percentage of mortality in the egg stage. This is quite clear in the eggs of *T. casteneum* and *T. confusum* taken at the beginning of November 1951 when hatching was 81.5 and 86% respectively ; and in those of *Latheticus* taken at the beginning of April 1952 when hatching was 50%. The percentage of hatching was much more higher during the warmer months ; in June 1952 it was 91.2, 93.8 and 93.2% respectively.

The larval stage

A. *Number of larval instars*

According to Wigglesworth (1950) the number of larval instars among insects is inconstant, and such variation may be due to heridity or may be determined by external conditions. Chapman (1918) and Brindley (1930) noticed that the larvae of the confused flour beetle moulted 5 times, having 6 larval instars. But Good (1933) has later stated that there is no fixed number of larval instars in both species of *Tribolium,* the number ranged between 5 and 11 or more; but the usual number is seven or eight. From his data it appears that the number of instars in *T. confusum* is slightly more than that of *T. castaneum.* He also stated that the variation in the number of larval instars was due to both external conditions such as temperature, humidity, food, etc., and also to individual characterestics entirely apart from external influence. Butler (1949) stated that the Tenebrionidae showed considerable individual variation and specific differences in the number of larval instars, and that the normal number in the Ulominae is 6-8. This may be increased to more than 11 under certain conditions of drought or starvation. As for *Latheticus oryzae,* apart from a short account given by Patton (1930) stating that there are 6-9 moults, detailed study is still lacking.

The data indicated in Table II show the number of larval instars in *T. confusum, T. castaneum* and *Latheticus oryzae* throughout the year. Whole-wheat flour was offered as food throughout the time of the experiment. A study of these results shows that in *T. castaneum* the number of larval instars lies between 5 and 7, the majority of the larvae (65.3%) having 6 larval instars. In both *T. confusum* and *Latheticus oryzae,* the number of instars lies between 6 and 9, the majority (87.4% in *T. confusum* and 60.4% in *Latheticus oryzae*) having 7 larval instars. It is obvious that the number of larval instars in *T. castaneum* tends to be somewhat less than that of both *T. confusum* and *Latheticus oryzae.* These results agree with those given by Good (1933) and Patton (1930).

TABLE II
Number of larval instars
of Tribolium castaneum, Tribolium confusum, *and* Latheticus oryzae
throughout the year

MONTHS	*Tribolium castaneum*				*Tribolium confusum*					*Latheticus oryzae*				
	Number of larvae having instars			Number of larvae used	Number of larvae having instars				Number of larvae used	Number of larvae having instars				Number of larvae used
	5	6	7		6	7	8	9		6	7	8	9	
July . . . 1951		63	18	81	3	43	1		52	28	29			57
August . . ,,		40	32	72	1	48	1		50	16	32	3		51
September ,,	2	38	4	44	5	29			34	27	34	3		64
October . . ,,		36	6	42	7	24	2	7	40		1	6	1	8
November . ,,						1	3	2	6					
March. . . 1952		23	21	44	6	47	2		55					
April . . . ,,		39	37	76	4	76	1		81	8	24	1		33
May . . . ,,		61	30	91	8	68			76	14	44	7		65
June . . . ,,	1	28	23	52	1	34			35	5	22	3		30
TOTAL NUMBER	3	328	171	502	35	375	10	9	429	98	186	23	1	308
PERCENTAGE	0.6	65.3	34.1	100	8.1	87.4	2.3	2.2	100	31.8	60.4	7.5	0.3	100

B. *Duration of the different larval instars*

Experiments carried out to determine the duration of the larval instars of *T. castaneum* and *T. confusum* indicate that the larval period is much affected by temperature, relative humidity and food. Holdaway stated that the length of larval life was shortened by increasing the humidity (after Chapman, 1931). Good (1936) reports that the larval period of *T. confusum* is somewhat longer than that of *T. castaneum* under the same conditions. The optimum temperature for the development of both species of *Tribolium* was recorded by this author to be about 30° C. Patton (1930) stated that the larval period of *T. confusum* might last from 14-36 days or more depending on temperature. The minimum temperature for the development of *T. confusum* was found to be about 14-16° C. (Menusan, 1936). Chapman and Baird (1934) showed that development of *T. confusum* would cease at 17° C. Butler (1949) stated that a large number of instars was correlated with a prolonged larval life.

The duration of the different larval instars was studied during the different months of the year and a summary of the results is shown in Table III. A study of the data, especially in those months in which the temperature was approximately regular as it was in July and August 1951, showed that the first instar was the shortest whereas the last one was almost the longest. The intervening instars were about equal, with the second tending to be

TABLE III

Duration of the larval period
of Tribolium castaneum, Tribolium confusum, *and* Latheticus oryzae
throughout the year (*in days*)

MONTHS	*Tribolium castaneum*			*Tribolium confusum*			*Latheticus oryzae*		
	Mean	Range	Number larvae used	Mean	Range	Number larvae used	Mean	Range	Number larvae used
July 1951	21.3±0.23	18-29	81	23.9±0.13	22-26	52	25.1±0.34	21-32	57
August ,,	21.1±0.28	18-29	72	23.3±0.17	22-27	50	26.9±0.71	21-35	51
September ,,	21.4±0.23	18-26	44	24.0±0.25	21-27	34	33.7±0.70	25·46	44
October ,,	37.5±08.0	30-49	42	42.8±1.05	31-32	31			
October ,,	over-wintered larvae			187.4±1.77	181-195	9	217.4±0 41	216-219	8
November ,,				169.8±1.53	165-174	5			
March 1952*	40.5±0.44	36-51	44	41.9±0.78	38-48	55			
April 1952	37 0±0.41	36-51	76	37.1±0.26	31-43	81			
April 1952**							38.1±0.81	31-51	33
May 1952	27.2±0.20	25-33	91	30.9±0.19	26-23	76	37.4±0.47	30 47	65
June ,,	25.5±0.23	20-26	52	25.3±0.23	21-29	35	29.3±0.65	25-37	30

* Eggs taken from 23rd to 30th March 1952.
** Eggs taken in the second half of April.

somewhat longer. This agrees with Brindly (1930), Park (1935) and Good (1936) in case of *T. confusum* and *T. castaneum*, and with Butler (1936) in case of *Palorus ratzburgi* (Coleoptera : Tenebrionidae). The duration of the larval instars of the three species in August 1951 is graphically represented in Figure 4.

All the larvae of *T. castaneum* taken at the beginning of November 1951 died in winter while in the second larval instar, and thus no larvae were found during the winter. The majority of the larvae died in the period from 7th to 20th December, 1951, the temperature at that time ranged between 13 and 18° C., with an average of 15.8° C.

In case of *T. confusum* very few larvae of October and November 1951 (9 out of 41 in October, and 5 out of 31 in November) survived and succeeded to overwinter. They completed their development later in March and April, 1952. The remaining larvae died and death mostly occurred between 6th and 18th February, 1952, temperature ranged between 14 and 19 with an average of 15.8° C.

Most of the larvae of *Latheticus oryzae* taken in October 1951 died in winter, but very few (8 out of 40) survived and resumed development in April 1952. Eggs laid by *Latheticus* at the beginning of April 1952 hatched but most of the ensuing larvae died in the first instar and some in the second, this was due to a spell of low temperature in April 1952 which lasted for ten days (from 6th to 17th April 1952); average temperature was 20.2° C.

Considering the larval period as a whole, it was found that the shortest periods for *T. castaneum* and *T. confusum* were 21.1 and 23.3 days respectively; and this occurred in August 1951. As for *Latheticus* the shortest period was 25.1 days, and this occurred in July 1951. The longest periods were: 40.5 days for *T. castaneum*, and this was for larvae starting at the beginning of March 1952; 187.4 days for *T. confusum* and 217.4 days for *L. oryzae* for larvae starting in October 1951.

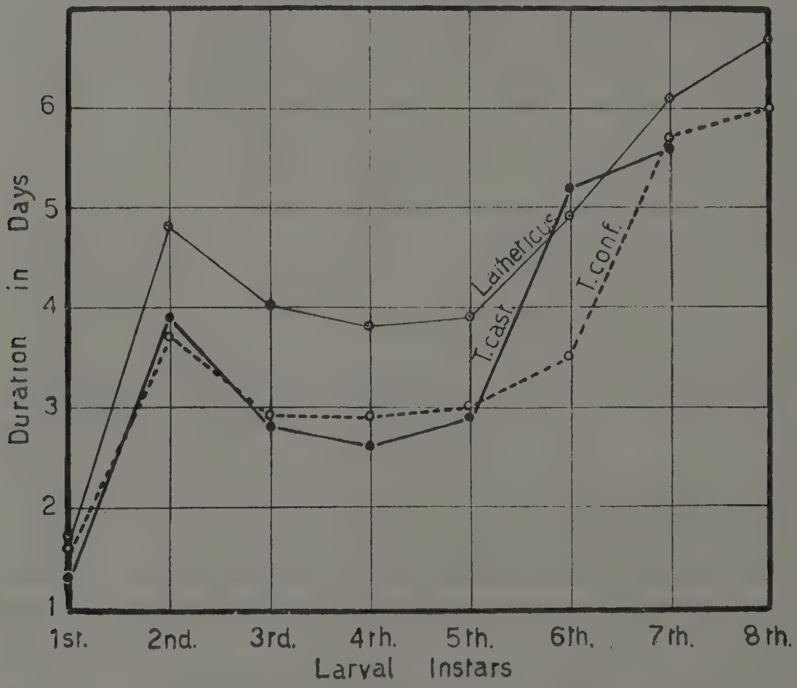

Fig. 4: Duration of the different larval instars in August 1951.

It is obvious that the larval period of *T. confusum* is a little longer than that of *T. castaneum* considering the shortest periods for both; and that the shortest larval period of *L. oryzae* is still longer than that of both species of *Tribolium*. The difference between *T. castaneum* and *T. confusum* is statiscally significant at 0.05 level of probability (P = < 0.001 for all months except March when it is < 0.01, and April when the difference is insignificant $P = > 0.10$). The difference between *T. confusum* and *L. oryzae* is also significant.

The pupal stage

When fully grown the larvae come to the surface of the food material and change to the prepupal stage. It is a quiescent non-feeding stage. After

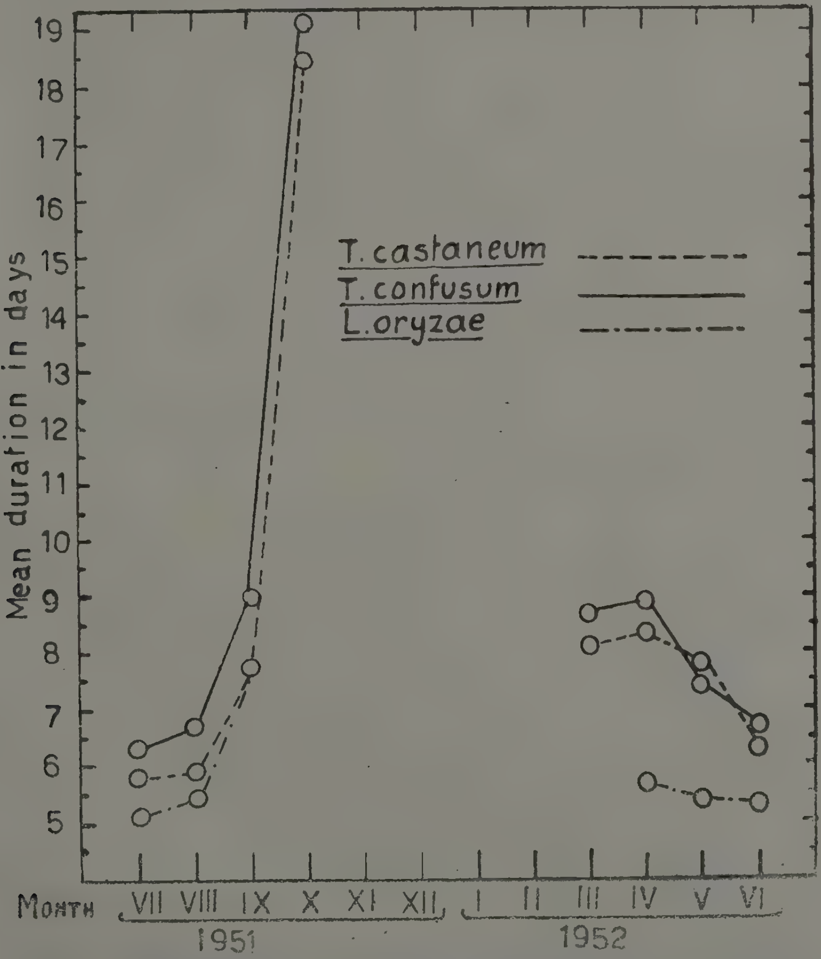

Fig. 5 : The duration of the pupal stage in the three species in the different months of the year (however, it happened on several occasions that pupation started in a month and ended in the following one).

a short time it moults giving rise to the pupal stage. The pupae when compared with the eggs and the larvae seem to be less affected by external conditions. Patton (1930) stated that the pupal stage of *T. confusum* lasted from 4-7 days or more according to temperature. Nagel and Shepard (1934) found that the numbers of hours required to obtain 100% mortality of the pupal stage at 7, -6, -12 and -18° C., were 432, 10, 1.5 and 0.5 hours respectively.

The duration of the pupal stage was studied during the different months of the year and it is represented in Figure 5. The shortest duration for the pupal stage of *T. castaneum, T. confusum* and *L. oryzae* was 5.8, 6.3 and 5.1 days respectively and this occurred in July 1951. The longest was 18.5, 19.2 and 7.7 days respectively, and this occurred in October 1951 in *Tribolium* beetles and in September in *Latheticus*. It seems that the pupal stage of *T. castaneum* is shorter than that of *T. confusum* under the same conditions, and that of *L. oryzae* tends to be shorter than that of both species of *Tribolium*.

In October 1951 the majority of the pupae of *T. castaneum* and *T. confusum* failed to give rise to adults. Only four adults of each species succeeded to emerge, the remaining pupae completed development but adults were unable to emerge. The same occurred in few specimens of *L. oryzae* during September 1951. From November 1951 to February 1952 for both species of *Tribolium* and from October 1951 to March 1952 for *Latheticus* no pupation took place in the overwintering larvae.

The preoviposition period

It is a well known fact that the preoviposition period in many insects is dependant on temperature. Good (1936) stated that the preoviposition period of *Tribolium* might range from four to an indefinite number of days according to temperature. He gave records of 14 matings of *T. confusum* and 11 of *T. castaneum* at 27° C., in which the beetles were mated 1-3 days after emergence. The females began to lay eggs at an average age of 8.7 and 8.2 days for the two species respectively. He also stated that the adults emerging during winter and kept under room temperature did not lay eggs till the approach of warm weather. Dick (1937) gave a preoviposition period of about 8 days for *T. confusum* at 27° C. and 65% relative humidity. Mathlein (1943) in his work upon *T. destructor* gave the following periods: 21 days at room temperature, 12 days at 26-28° C., and up to or more than 4 months at 12-16° C.

Table IV represents the preoviposition period in *T. castaneum, T. confusum* and *L. oryzae* throughout the year. In these observations all the females were isolated on the day of emergence and kept each with a male of

TABLE IV

Developmental periods and duration of generations (in days)
of Tribolium castaneum, Tribolium confusum, *and* Latheticus oryzae, *throughout the year*

MONTHS	*Tribolium castaneum*					*Tribolium confusum*					*Latheticus oryzae*				
	Developmental period		Pre-oviposition period		Duration of generation	Developmental period		Pre-oviposition period		Duration of generation	Developmental period		Pre-oviposition period		Duration of generation
	Duration	Number of insects used	Duration	Number of insects used		Duration	Number of insects used	Duration	Number of insects used		Duration	Number of insects used	Duration	Number of insects used	
July 1951	30.6±0.22	79	5.4	10	36.0	35.0±0.16	52	6.8	10	41.8	35.0±0 33	57	8.2	10	43.2
August 1951	30.8±0.27	71	6.8	10	37.6	35.1±0.18	50	7.8	10	42.9	37.1±0.85	48	9.1	10	46.2
September 1951	32.8±0.22	44	7.8	10	40.6	38.4±0.31	34	10.4	10	48 8	47.2±1.00	39	197.0	10	244.2
October 1951*	53.7±0.75	4	129.2	4	182.9	57.0±0.40	4	125.3	4	182.3					
October 1951**						209.1±1.70	9	9.7	9	218.8	231.5±0.56	8	7.4	8	238.9
November 1951						192.4±1.08	5	8.2	5	200.6					
March 1952	56.2±0.45	44	7.0	10	63.2	60.8±0.32	55	8.7	10	69.5					
April 1952°	55.1±0.32	76	7.1	10	62.2	58.9±0.19	81	8.8	10	67.7					
April 1952°°											53.6±0.67	33	5.7	10	59.3
May 1952	40.7±0.21	91	4.9	10	45.6	45.5±0.19	76	6.2	10	52.7	50.5±0.49	65	5.7	10	56.0
June 1952	33.4±0.21	51	5.1	10	38.5	38.4±0.22	35	6.7	10	45.1	41.5±1.78	30	6.6	10	48.1

*, Adults emerged before winter. — **, Adults emerged in early summer.
°, Eggs were taken at the beginning of the month. — °°, Eggs taken in the second half of the month.

approximately the same age. Insects were provided with whole-wheat flour as food. Daily observations were carried out till the first egg was laid. From this Table it appears that this period greatly varies in the different months of the year ; the shortest periods occurred in those insects reared at the beginning of May 1952 and were 4.9, 6.2 and 5.7 days for *T. castaneum, T. confusum* and *L. oryzae* respectively. The adults emerged and the preoviposition period occurred at the middle of June. The temperature during this period ranged between 25 and 31° C., with an average of 27.8° C., the relative humidity ranged between 45 and 71.8% with an average of 58.9%. It was also clear that the preoviposition period was much prolonged in those insects emerging late in autumn and at the beginning of winter (September and October 1951). The longest preoviposition periods were 129.2, 125.3 and 197 days for *T. castaneum, T. confusum* and *L. oryzae* respectively.

The number of generations throughout the year

In most insects the developmental period, from egg to adult, shows a wide range according to environmental conditions. This wide range is mostly due to the varying rate of growth of the larval stage which is much affected by these conditions. Chittenden (1897) stated that *T. confusum* can undergo its entire round of transformation at high temperature in about 36 days, but in spring and autumn this period is much prolonged. Brindley (1930) gives an average life-cycle of 30.2 days for *T. confusum* at 30° C. and 73% relative humidity using whole-wheat flour as food. Patton (1930) showed that the complete life-cycle of *T. confusum* took from 50-90 days depending on temperature. He also stated that in India, the life-history of *L. oryzae* lasted from 25-40 days according to temperature and relative humidity. Park (1934) reported that 30 days represented the usual length of life-cycle in *T. confusum.* He summarized the observations of Chapman (1921), Chapman and Baird (1934), and Stanley (1939) on *T. confusum* as follows : at 32, 27 and 22° C., and 75% relative humidity and with whole-wheat flour as food, the life-cycles of this insect were 27, 37 and 93 days respectively. Data given by Good (1936) indicate that at 27° C., the life-cycles of both *T. confusum* and *T. castaneum* range between 34 and 114 days respectively depending on the food offered. In case of *T. castaneum* the life-cycles range between 53 and 76 days (average 63.4 days) at 25° C., between 41 and 56 days (average 43.7) at 27° C. and between 30 and 36 days (average 32.7 days) at 30° C. Back and Cotton (1940) show that the developmental period, from egg to adult, in *T. confusum* is six weeks under favourable conditions, and that the life-cycle is greatly prolonged in cold weather as occurs in all grain pests. Willcocks (1922) stated that during summer the time required for the development of *Tribolium* beetles (from egg to adult) was about six weeks, and that this period might be very much prolonged in winter. He also added that the larvae which hatched in October and November developed very slowly and might not pupate till the following spring.

The life-cycles of *T. castaneum*, *T. confusum* and *L. oryzae* are represented in Table IV. Whole-wheat flour was offered as food. It is quite clear that the developmental period is much affected by temperature ; the shortest period occurred in the hottest months of the year : July and August 1951, when the mean temperature was 30 and 30.6° C., and the mean relative humidity 57.6 and 60.8% respectively. It also appears that the life cycle of *T. confusum* is generally longer than that of *T. castaneum*, the difference between the means is statistically significant (P = < 0.001 at 0.05 level of probability). These results agree with those obtained by the preceding authors. The life-cycle of *L. oryzae* is generally much longer than that of *T. confusum ;* the difference between the means is statistically significant except in July 1951 when the developmental periods are both equal (P = < 0.001 for all months except August when it is < 0.02).

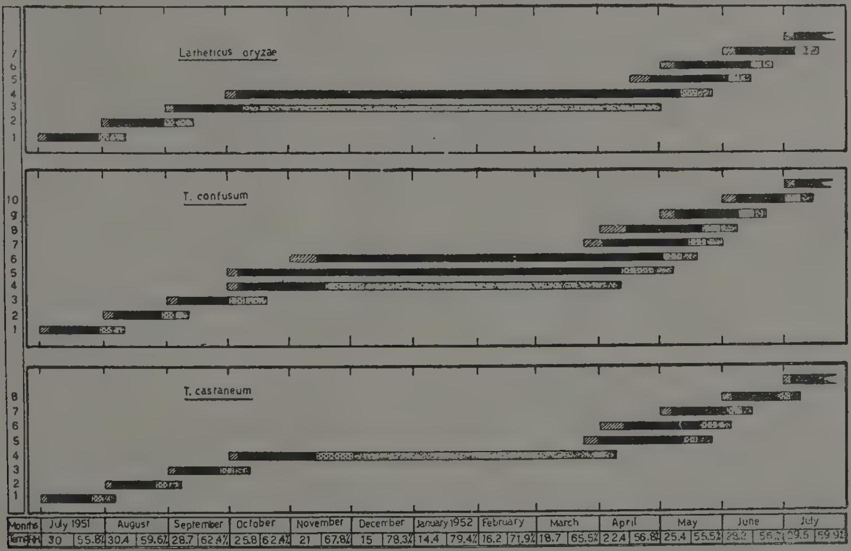

Fig. 6: Number of generations throughout the year.

The approximate number of generations may be designated graphically by considering the length of the full life-cycle as the sum total of : the preoviposition, the incubation, the larval and pupal periods. As the oviposition period of these insects is very long the overlapping of generations generally occurs, and in Figure 6 this period has been disregarded. It can be concluded, therefore, that *T. castaneum* has about six generations a year, *T. confusum* five to six, while *L. oryzae* has only four to five generations. Such a representation has been given by Attia (1932) in his study on *Calandra oryzae,* and also by Attia and Matter (1939) in *Phthorimaea operculella.*

Seasonal life-history

There is a general agreement among workers that the only stage which can survive the winter in *T. castaneum* and *T. confusum* is the adult stage. It has been stated by Good (1933) that *Tribolium* breeds all the year round in heated buildings, and that all stages can be found at any time of the year. He was able to find many adults of *T. confusum* in unheated flour-mills in Maryland and Northern Virginiana during February 1931, but no larvae or pupae were observed. He concluded that in these States, the winter is passed in the adult stage and breeding begins with the approach of spring, while in the Gulf States breeding is continuous. He also stated that *T. castaneum* seems to be less resistant to cold than *T. confusum.* Nagel and Shepard (1934) showed that a temperature of 7° C., killed all stages of *T. confusum* in not more than 22 days' exposure, and that the adults and the fully grown larvae were most resistant. Butler (1949) stated that in the Ulominae the winter was passed in the adult stage and oviposition was restricted to the warm part of the year.

In the present work the larvae of those eggs taken at the beginning of October and November 1951, met the cold weather of the winter and showed some variability in their resistance to cold in the three species. Of the eggs taken in October 1951 only four adults of both *T. castaneum* and *T. confusum* succeeded to emerge late in November 1951, but did not lay eggs till late in March 1952; the rest (27 of *T. castaneum* and 25 of *T. confusum*) died in the pupal stage. Some of them completed development but the adults failed to get rid of their pupal skin and died. However, it was found that a few number of larvae were able to survive the winter, in *T. confusum* nine larvae developed slowly and succeeded to overwinter and completed their development in March 1952. In *L. oryzae* development was very slow and none of the larvae reached the pupal stage; only eight succeeded to overwinter and completed development at the beginning of April 1952, the rest died with the approach of the cold weather.

Of the eggs taken at the beginning of November 1951, all the ensuing larvae of *T. castaneum* died with the approach of January 1952 ; very few larvae of *T. confusum* (5 out of 31) succeeded to overwinter and gave rise to adults which emerged in May 1952, the others died. In *L. oryzae* no eggs were laid in November 1951, but eggs laid at the beginning of April 1952 succeeded to hatch but died in the first or second larval instars due to a fall in the atmospheric temperature, those taken in the second half of the month completed their development normally.

By inspection of cultures of *T. castaneum, T. confusum* and *L. oryzae* in the winter of 1951-1952, adults of the three beetles were found in a semi-dormant state, burried in the flour. Very few fully grown larvae were observed in the cultures of the three species. In *Tribolium* it was also observed that egg laying stopped from about the middle of November 1951 till the middle of March 1952 and in *Latheticus* from middle of October 1951 till the beginning of April 1952.

From the observations mentioned above it may be concluded that only the adult stage and few larvae can pass the winter, but all other stages would die. Eggs which were obtained from adults placed in an incubator running at 28° C., during the winter were unable to hatch when placed under laboratory conditions.

Effect of mating on oviposition

It is a well known fact that oviposition may occur among Coleoptera before mating. Observations carried out by Larson and Fisher (1935) on *Bruchus quadrimaculatus,* and by El-Sayed (1935) on *Araeoccrus fasciculatus* showed that virgin females were able to lay a few eggs which did not hatch. Dick (1937) made an observation on twenty newly emerged females of *T. confusum,* every female was isolated in a separate tube provided with whole-maize flour and kept at 27° C., and 65% relative humidity. The experiment continued for 128 days during which time egg-count was made; the average number of eggs was 0.5 eggs per day and the largest number laid by a single female in 8-day period was 19 eggs. All eggs shrivelled and failed to hatch.

In the present work two groups of *T. confusum, T. castaneum* and *L. oryzae* were used, each group comprised 10 females. The first group contained virgin females and every one was isolated in a separate tube just before emergence. The egg-laying behaviour of these females was studied and compared with that of a second group of females which were provided with males of the same age. All insects were supplied with whole-wheat flour which was renewed every day when egg-count was made. The experiment continued for a period of thirty days, from 12th June to 12th July. In *T. castaneum* all virgin females were able to lay but a few number of eggs as compared with the mated ones. The average numbers of eggs laid by mated and unmated females during the experimental period were 139.1 and 45.1

eggs respectively. In *T. confusum* and *L. oryzae* some of the virgin females produced a very few number of eggs and the others did not lay eggs at all. The average number of eggs laid by mated and unmated females of *T. confusum* were 157.7 and 4.4 eggs respectively, and for *L. oryzae* 71.9 and 1.2 eggs respectively. The average preoviposition periods in the unmated females of *T. confusum* and *L. oryzae* were 11.3 and 9 days respectively; while in the mated females these were 6.3 and 5.6 days respectively. In *T. castaneum* the preoviposition period in mated and unmated females was approximately equal, i.e. 5.1 and 3.2 days respectively. Eggs produced by unfertilized females were sterile and failed to hatch, while those of the controls were viable.

Number of eggs laid throughout a year

From the results given by Good (1939) it is shown that the length of the oviposition period depends on food as well as temperature. The average oviposition periods for *T. castaneum* and *T. confusum* at 27° C., and on whole-wheat flour, were 170.5 and 217.6 days respectively. Under room conditions he gave the average oviposition periods of 160.3 and 267.7 days for both species respectively. The longest periods obtained by the same author in different food materials and under laboratory conditions were 308 and 432 days for the two species respectively. Willcocks (1922) stated that in cold weather *Tribolium* beetles seem to lay no eggs at all or only very few.

In the present work five pairs of every species of *T. castaneum* and *T. confusum* and six pairs of *L. oryzae* were isolated just before emergence. Every pair was placed in a separate tube and provided with a sufficient amount of whole-wheat flour. Daily counts of eggs were made for a period of about one year, and the conclusions which can be drawn from this experiment are : (1) *Tribolium* beetles ceased to lay eggs in the middle of November 1951 and resumed egg-laying late in March 1952, while those of *L. oryzae* stopped egg-laying late in October 1951 and started again in April 1952. It is safe to deduce, therefore, that the minimum temperature for oviposition in *Tribolium* is somewhat lower than that of *Latheticus.* (2) The oviposition period of *T. confusum* is much longer than that of *T. castaneum* and *L. oryzae.* At the time when the females of *T. castaneum* and *L. oryzae* ceased to lay eggs those of *T. confusum* were still laying. (3) The average number of eggs laid by *T. confusum* was higher than that of *T. castaneum* and *L. oryzae,* these were 1069.2, 516.2 and 330.0 eggs respectively. The average rate of egg-production per female per day amounted to 4.9, 2.4 and 2.2 eggs respectively. (4) The number of eggs laid was dependent on temperature. This is clearly indicated in Figure 7, which represents the egg-laying behaviour of a representative of each group. It appears that egg-production was at its highest level in June and July 1952 for *T. castaneum* and *T. confusum* respectively.

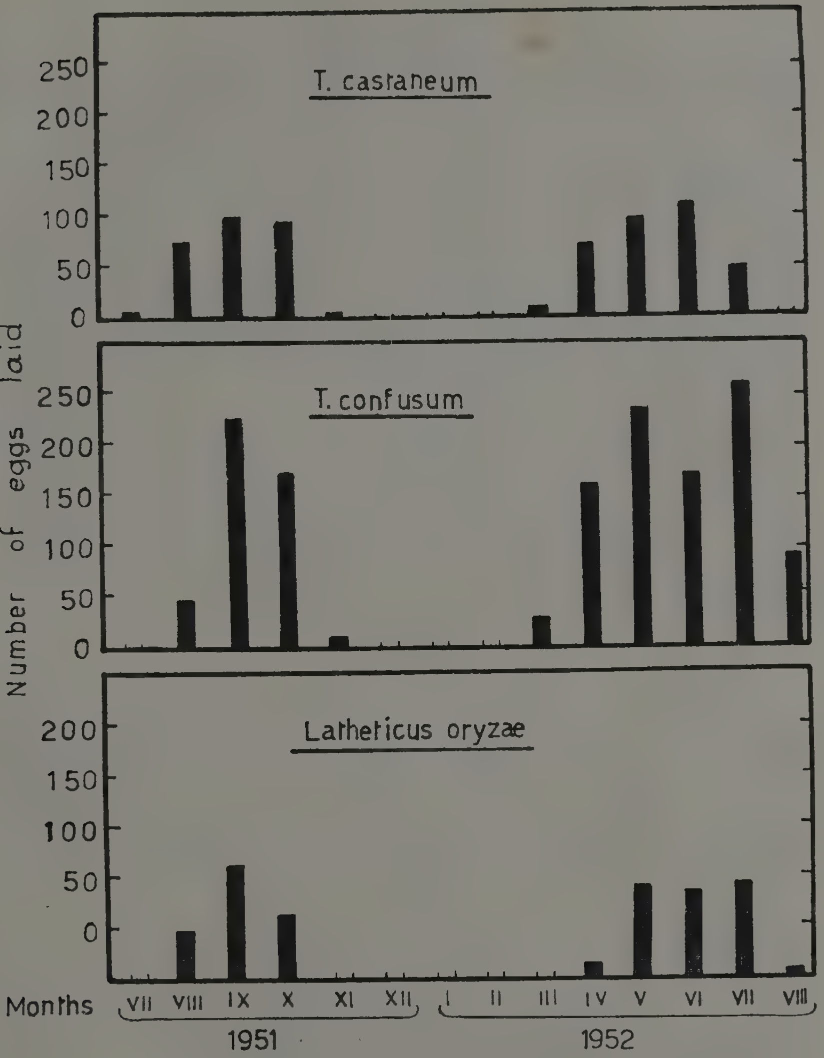

Fig. 7: Total egg-output of *T. castaneum, T. confusum,* and *Latheticus oryzae* during the different months of a year (1951-1952).

As for *L. oryzae* it was found that egg-production in September 1951 was higher than that in July 1952, although the average temperatures of these months were 28.7 and 30.0° C. respectively. The reason for this unexpected result is not clear but it may be a matter of age.

Effect of starvation

The length of starvation period is in direct relation with the relative humidity but increases inversely with temperature. In *T. confusum* Brindley (1930) found that the average starvation period for 20 beetles reared from the pupae and given no food except their pupal skin was 12 days. Good (1936) stated that starvation equally affects adults of both *T. castaneum* and *T. confusum*. At 30° C. the beetles survived for about two weeks, the longest period was 18 days, but for the larvae it was 23 days. During winter the longest period for adults was 23 days, and a single larva survived for 46 days. At 15° C some adults survived for 27 days, and the last larva was still alive after 54 days. He concluded that larvae are slightly more resistant to starvation than adults. He also states that starved larvae were able to moult and reach the adult stage.

In July 1952 an experiment was carried out in order to determine the starvation period of adults, as well as the first and the third larval instars of *T. castaneum, T. confusum* and *L. oryzae*. Ten individuals of every stage were placed in separate vials without food and kept under room conditions. The adult insects and the third larval instars were taken from the main cultures, adults were not more than one month old. All insects were daily examined and the date of death was recorded.

The adult stage

The results of this experiment show that the starvation period for *T. castaneum* and *T. confusum* is almost equal. It was 15.1±1.12 and 13.6±0.56 days in the males, but 17.9±1.24 and 18.0±1.15 days in the females in the two species respectively. The starvation period of *L. oryzae* was much shorter, i.e., 8.1±0.35 in the males and 10.2±0.73 days in the females. The starvation period of adult females tends generally to be somewhat longer than that of the males.

The first larval instar

The first stage larvae were generally able to moult and enter the second larval instar and then died. The period from hatching till death was almost similar in *T. confusum* and *T. castaneum* (6.6 ± 0.70 and 6.2 ± 0.68 days respectively); but in *L. oryzae* it was 9.6 ± 1.04 days.

The third larval instar

The behaviour of the third instar larvae was somewhat different, some were able to moult and enter into the fourth instar, but others were unable to do so. The starvation periods for *T. castaneum, T. confusum* and *L. oryzae* were 12.8 ± 1.17, 11.9 ± 0.67 and 14.7 ± 1.28 days respectively.

SUMMARY

(1) The study of the biology of the three beetles *T. castaneum, T. confusum* and *L. oryzae* was carried out throughout the year 1951-1952 under laboratory conditions.

(2) The incubation period of *T. castaneum* seems to be slightly shorter than that of *T. confusum* while that of *L. oryzae* is approximately similar to that of *T. confusum*. The shortest periods obtained were 3.5, 4.9 and 4.4 days, for *T. castaneum, T. confusum* and *L. oryzae* respectively, and this occurred in July 1951 in *Tribolium* beetles and August 1951 in *L. oryzae*. The longest period were 12.2, 13.6 and 17.9 days for the same insects respectively and this occurred in April 1952 in *T. castaneum* and *L. oryzae,* and in November 1951 in *T. confusum*. The percentage of viable eggs is approximately 80-95 in *Tribolium* and 75-95 in *L. oryzae.*

(3) Under the same conditions of temperature and food the number of larval instars in *T. castaneum* tends to be somewhat less than that of both *T. confusum* and *L. oryzae*. The approximate numbers of larval instars were 6 and 7 for the three species. The duration of the first larval instar was found to be the shortest, while that of the last one was the longest; the duration of the intervening instars were about equal with the second tending to be somewhat longer.

(4) Considering the larval period as a whole, it was found that the larval period of *T. confusum* was little longer than that of *T. castaneum,* that of *L. oryzae* was still longer than both. The shortest periods obtained were 21.1, 23.3 and 25.1 days for *T. castaneum*, *T. confusum* and *L. oryzae* respectively, and this occurred in August 1951 in *Tribolium* and in July 1951 in *L. oryzae.*

(5) The duration of the pupal stage of *T. castaneum* was shorter than that of *T. confusum,* that of *L. oryzae* tends to be still shorter. The shortest periods were 5.8, 6.3 and 5.1 days for *T. castaneum, T. confusum* and *L. oryzae* respectively. This occurred in July 1951. The longest periods were 18.5, 19.2 and 7.7 days for the same species respectively, and this occurred in October 1951 in *Tribolium* and in September 1951 in *L. oryzae.*

(6) The shortest preoviposition periods for *T. castaneum, T. confusum* and *L. oryzae* were 4.9, 6.2 and 5.7 days respectively and this occurred in May 1952, the longest were 129.2, 125.3 and 197 days for the same insects respectively, and this occurred in those insects which emerged at the begining of the autumn 1951.

(7) *T. castaneum* has 6 generations a year, *T. confusum* has 5-6 and *L. oryzae* has 4-5. The adult stage of the three species and very few advanced larvae can pass the winter.

(8) Mating was found to be essential for the production of fertile eggs. Unfertilized females, however, produced few sterile eggs.

(9) *Tribolium* beetles ceased to lay eggs in the middle of November 1951 and resumed egg-laying late in March 1952; while those of *L. oryzae* stopped egg-laying late in October 1951 and started again late in April 1952. Therefore, the minimum temperature for oviposition in *Tribolium* is somewhat lower than that of *L. oryzae*. The oviposition period of *T. confusum* was found to be much longer than that of both *T. castaneum* and *L. oryzae*.

(10) The starvation period of both sexes of *T. confusum* and *T. castaneum* seemed to be almost equal, that of *L. oryzae* was much shorter. The starvation period of adult females tended to be somewhat longer than that of males. This was common for the three species under consideration. The first stage larvae were generally able to moult and enter into the second instar and then died. Some of the third instar larvae were able to moult and enter into the fourth instar, but others were unable to do so. All the last larvae, although starved, were able to enter into the prepupal and pupal stages and later gave rise to adults.

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Preliminary studies on the carbohydrate storage in the honeybee, *Apis mellifica*

[Hymenoptera : Apidae]

(with 1 Text-Figure, and 1 Table)

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INTRODUCTION

As honey production depends directly on the activity of bees it is obviously clear that the honey crop reaches its maximum when favorable conditions prevail. This fact enthused the authors to investigate the effect of temperature, food and wind, being the main factors to which bees are subjected in nature, on their carbohydrate content which is suspected to be the source of energy of the insect activity.

Material and methods

Worker bees (Egyptian variety) of about 2 months old from an overwintering hive have been used during this experiment. The hive contained excess of honey and pollen and had no brood during the course of this study.

Insects were transferred from the hive to laboratory in a show hive. Bees were easily handled during their transfer from one container to the other after being anesthetized with ether. In each experiment anesthetized bees were transferred from the show hive to the rearing boxes. About 80 bees were introduced in a rearing cardboard box of dimentions of about 3×5×8" with a paper covered glass bottom and a glass top and with two wire screened ventilation openings. Each box was supplied with a water container and a side tube to add water to the container whenever necessary was also fitted into the box. In case of a fed bees, a honey container was also introduced into the rearing box. Various bee lots were subjected to different temperatures ranging from 10 to 35° C., some fed and others starved. In one case bees were disturbed by exposing them within a cage to a fan blown air current.

Each treatment was duplicated and the average carbohydrate content in both was considered.

The glycogen of the body tissues was determined using a known weight (about 6 grams) of ether anesthetized bees and treating them according to

TABLE I

Effect of temperature, food, and wind on the carbohydrate content of honeybees

TREATMENT	CARBOHYDRATE CONTENT EXPRESSED AS MG. GLUCOSE PER 100 GRAMS BODY WEIGHT		
	In fed bees	In starved bees	Remarks
Kept 3 days at 10° C. .. :	73 (72-74)	73	Bees clustered and did not feed
Kept 3 days at 15° C. . .	44 (42-46)	22 (20-24)	No activity.
Kept 3 days at 20° C. . .	35 (32-38)	14 (13-15)	Slightly active.
Kept 3 days at 25° C. . .	42 (40-44)	26 (23-29)	Active.
Kept 3 days at 30° C. . .	54 (51-57)	20 (19-21)	Active. High mortality in starved bees
Kept 3 days at 35° C. . .	33 (31-35)	10 (9.5-10.5)	Restless. Very high mortality of starved bees.
Taken directly from hive at temperature about 25° C. .	40 (36-44)		
Fan disturbed for 12 hours at about 25° C.	28 (26-30)	16 (14.5-17.5)	Bees greatly disturbed, placed in a wire cage of 10x10x15".

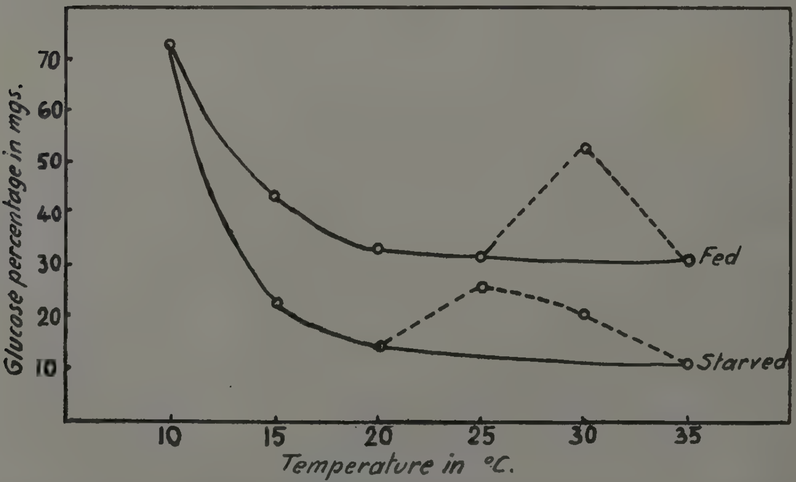

Fig. 1: Curve showing the variation of carbohydrate content in honeybees at different temperatures and various feeding conditions.

the method of Good, Kramer and Somogyi (1933) which is a modification of Pfluger's technique improved by Eisa (publication in press). The glucose content of the neutralised hydrolysate as well as any other already present glucose was determined by Somogyi's method (Somogyi et al, 1930) employing the iodometric titration of reduced copper.

Experimental results

The results of the present experiments are presented in Table I and are expressed as a Graph in Figure 1.

Discussion and conclusions

Results arrived at here show that :

1. The carbohydrate content of honeybees varies considerably according to the feeding condition. In case of feeding the level is much higher than in starvation. This fact agrees with the findings of Beutler (1936) who stated that the sugar in bees' blood decreases considerably with starvation.

In both cases of feeding and starvation during the present study the carbohydrate amount generally decreases with rise of temperature. This diminution results from the utilization of carbohydrates which supply the energy needed for the increased activity.

2. In case of feeding the curve shows a deviated portion representing an increase in carbohydrate at about 30° C. This deviation can be explained by the possible increased appetite at this temperature. The extra amount of food taken adds to the already present carbohydrates.

In case of starvation a similar deviation is noticed at temperatures of about 25 to 30° C. At these temperatures the energy needed to compensate with the activity induced by rise of temperature is probably taken from the destruction of body tissues as long as no external source of food is available. This process leads to the noticeable increased carbohydrate content due to a series of metabolic processes in the body.

3. The effect of activity on carbohydrates stores of bees is highly manifested when an additional activating factor is induced as shown in case of the fan disturbance action. The insect, in spite of being subjected to the fan action for only twelve hours yet its carbohydrate content decreased to about half its amount at the same temperature in case of non-disturbance. This is true in both feeding and starved conditions, a fact that supports the view considering that the activity increases on the expense of carbohydrate utilization.

This discussion leads to the conclusion that factors interferring with the normal activity of bees such as wind, scarcity of food and unfavourable temperatures result in a decrease of the carbohydrate stores of the body.

Bees should therefore be protected from being exposed to such factors in order to ensure a maximal honey production.

SUMMARY

The amount of carbohydrate in honeybee body was studied under various conditions and it was found to decrease with rise of temperature, high wind action and starvation.

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A new Eriophyid mite on Mango from Egypt

[Acarina]

(with 16 Text-Figures)

MAW

by Hassan H. Attiah,
Entomological Section, Ministry of Agriculture, Dokki, Egypt.

Vasates mangiferae nov. spec.

Female: 174-243 μ long from front edge of the shield (without the lobes) to the base of the caudal setae, 69-76 μ broad anteriorly, shape spindle form, short or long, colour yellowish.

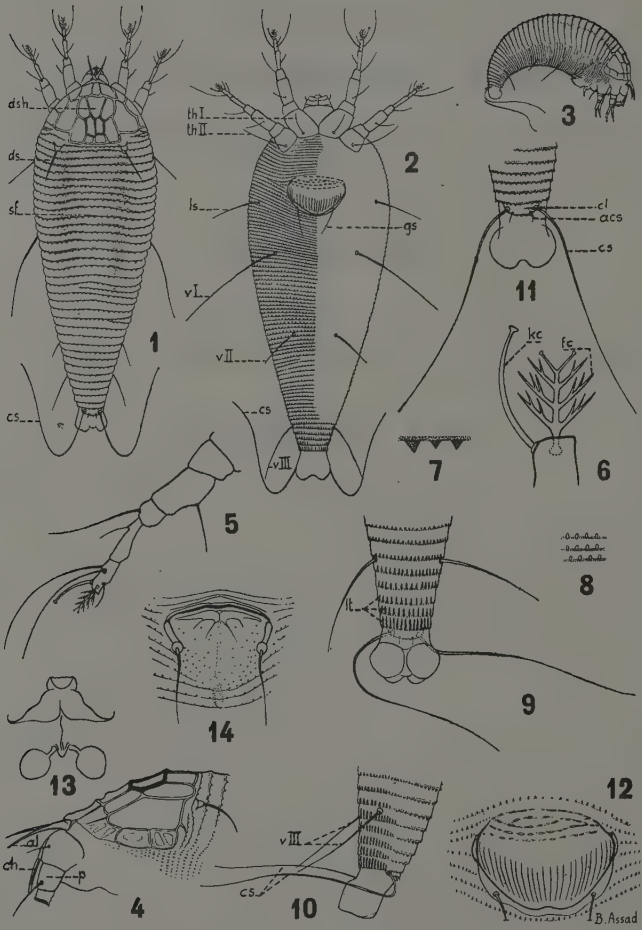
Rostrum small, curved down, base covered with the dorsal shield.

Palpi (fig. 4) with 3 unequal segments, the distal one rectangular in shape and the smallest in size, the middle one provided with a rather long and fine lateral bristle, the basal segment with a very fine one.

Chelicerae (fig. 4) fine, styliform, and lying between palpi.

Dorsal shield (figs. 1 and 4) broad, subtriangular, about 43,5 μ long and 68 μ wide, with two long pointed lobes in front, structure net-like. Dorsal tubercles at the rear shield margin directing the dorsal setae caudad, dorsal setae 19.5 μ long.

Legs : 2 pairs placed anteriorly, 6-jointed (fig. 5), moderately slender ; coxa I larger in size than coxa II; other joints nearly the same in length in both legs ; tibia conspicuously long and a little shorter than femur. Tarsus I ends in: (1) a 4-rayed feather claw bifurcating at its distal end ; (2) a dorsal knobbed claw, slightly longer than feather claw, 7 μ long (fig. 6) ; (3) two dorso-lateral long bristles about same length ; (4) one ventral short bristle, shorter than the knobbed claw. In tarsus II, the two dorso-lateral hairs are not equal in length, the interior one being about 1/3 the exterior. Tibia I 10 μ long, with a dorsal hair which is missing in tibia II. Patella I carries a dorsal hair which is much longer than that of patella II. Femur I carries a ventral hair which is a little longer than that of femur II. Trochanters I and II deprived of bristles. Coxa I provided with thoracic sera I, 11 μ long ; coxa II with thoracic seta II, 25 μ long (fig. 2).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B. Assad

Vasates mangiferae m.

Fig. 1: Dorsal aspect (*cs*, caudal seta; *ds*, dorsal seta; *dsh*, dorsal shield; *sf*, subdorsal furrow). — Fig. 2: Ventral aspect (*cs*, caudal seta; *gs*, genital seta; *ls*, lateral seta; *thI*, thoracic seta I; *thII*, thoracic seta II; *vI*, ventral seta I; *vII*, ventral seta II; *vIII*, ventral seta III). — Fig. 3: Lateral aspect. — Fig. 4: Lateral view of capitulum and dorsal shield (*al*, anterior lobe; *ch*, chelicerae; *p*, palp). — Fig. 5: Leg I, lateral view. — Fig. 6: End of tarsi (*fc*, feather claw; *kc*, knobbed claw). — Fig. 7: Spined tubercles of tergites. — Fig. 8: Round tubercles of sternites. — Fig. 9: Posterior end of the mite, ventral (*lt*, longitudinal tubercles). — Fig. 10: Posterior end of the mite, lateral (*cs*, caudal seta; *vIII*, ventral seta III). — Fig. 11: Posterior end of the mite, dorsal (*acs*, accessory seta; *cl*, caudal lobe; *cs*, caudal seta). — Fig. 12: Female genitalia. — Fig. 13: Anterior apodeme of female genitalia. — Fig. 14: Male genitalia.

Abdomen with two slight subdorsal furrows fading out posteriorly (fig. 1). Tergites about 28-35 in number, sometimes incomplete or confused, tuberculated with spined microtubercles (fig. 7). Sternites about 80, heavily tuberculated with microrounded tubercles (fig. 8), tubercles of the last posterior ones elongate and exceeding in length posteriorly (figs. 9, 10). Lateral setae 24 μ long and lie on the 18th ring anteriorly. Ventral I, 58 μ long and lie about 14 rings behind; ventral II, 19 μ long and about 20 rings behind; ventral III, 30 μ long and about 23 rings behind and on the 5th ring from rear. Caudal and accessory setae arise from a lobe behind the last tergite. This lobe is microspined between the accessory setae (fig. 11). Caudal setae about 64 μ long.

Female genitalia (fig. 12) 28.5 μ wide and lies a moderate distance behind the coxae. Coverflap longitudinally furrowed; genital setae 14 μ long, one pair just behind the genitalia. Anterior apodeme (fig. 13) of moderate length.

Male: about 170 μ long, genital width 20.5 μ, genital setae 15 μ long (fig. 14).

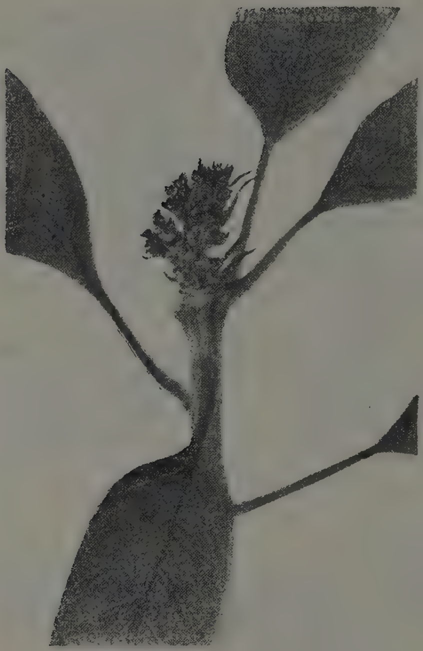
General remarks

(1) *Vasates mangiferae* m. was first found by the writer on 10.iii.53 infesting terminal buds and inflorescences of Mango trees in Giza near Cairo, and later on in other places.

(2) It seems that this mite is of great economic importance. Symptoms of attack begin by a russeting appearance in both terminal buds and inflorescences. This appearance is accompanied in many cases, by a liquid excretion. Buds and inflorescences stop growing and ultimately dry off as a result of the great number of mites feeding on them. Dead buds and dwarfed dry inflorescences (fig. 15) are easily seen on severely infested trees.

(3) These symptoms are different from those caused by *Aceria mangiferae* Sayed which also infests the terminal buds and inflorescences of Mango trees. *Aceria mangiferae* is slow in both effect and motion; it weakens the terminal bud and consequently, many lateral buds around it grow up forming a stunting appearance (fig. 16). Ultimately, infested buds die and hence, growth is hindered. *Vasates mangiferae,* on the contrary, is much more active and causes a quicker effect on the bud which dries without producing any lateral buds. Moreover, it seems that the symptoms of attack appear earlier than those of *Aceria mangiferae.* After a short time, one hardly finds free buds.

(4) The two mites were sometimes found infesting a same tree but seldom a same bud.



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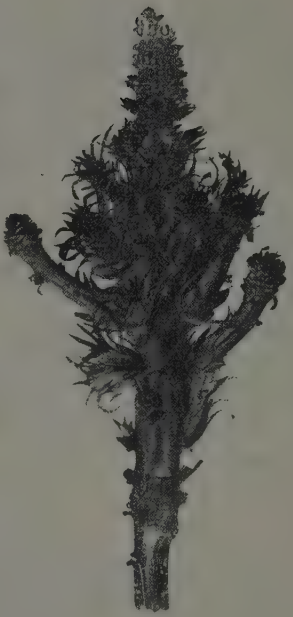

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Fig. 15: Dwarfed, dry inflorescences. — Fig. 16 : Stunted buds.

Means of control

Since *Vasates mangiferae* is active, it is often exposed, while *Aceria mangiferae* is almost hidden beneath the scales of the buds. Hence, *Vasates mangiferae* is much easier to control than *Aceria mangiferae.* 1% wettable sulphur gave good results (about 96% mortality) in controlling *Vasates mangiferae,* but infestation must be discovered early and spraying must be applied as soon as possible. Systemic compounds Pestox 3 and Systox 50% were tried by pouring around the stem of the trees at the rate of 24 litres diluted solution for a 4 meters high tree at the concentrations of 100 cc. Systox, 200 cc. Systox and 200 cc. Pestox per 100 litres water. No satisfactory results were obtained.

Some typical differences between *Vasates mangiferae* and *Aceria mangiferae*

	Vasates mangiferae	*Aceria mangiferae*
SHAPE	Spindle form.	Vermiform.
COLOUR	Yellowish.	Rather whitish or somewhat creamy.
ABDOMEN	Rings are divided into dorsal half rings (tergites) and ventral half rings (sternites). It follows the Phyllocoptinae.	Rings are subequal dorsally and ventrally. It follows the Eriophyinæ.
LEGS	Feather claw 4-rayed; tibia conspicuously long, longer than tarsus; thoracic setæ 2 pairs, one pair from each pair of coxæ.	Feather claw 6-rayed; tibia not long, about as long as tarsus; thoracic setae 3 pairs, 2 pairs from coxae I, and one pair from coxae II.

ACKNOWLEDGMENTS

The author acknowledges with grateful thanks, the kind help of Dr. H.H. Keifer the well known Acarologist of the U.S. Department of Agriculture, California. Preparations of the mite were sent to him and he stated that the mite is a new species and of the Genus *Vasates.* Thanks are also due to Dr. M.T. Sayed, our Egyptian Acarologist and my first teacher of Acarina, to whom I am greatly indebted. He furnished me with his valuable advices and he kindly revised this work. I am indebted to Mr. B. Assaad for his great help in the drawings, and to the members of the staff of the Acarina Subsection of the Entomological Section for their kind help in experiments of control.

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The morphology of three weevil larvae from Egypt

[Coleoptera : Curculionidae]

(with 3 Text-Figures)

by S.M. HAMMAD, Ph.D. (Bristol), and A.L. EL-DEEB, Ph.D. (Illinois),
Faculty of Agriculture, Alexandria University

INTRODUCTION

The larvae described in this paper were obtained by the authors from the Alexandria district, in April 1953. They belong to the wood-borer *Rhyncolus cylindrus* Boh. which attacked a poplar tree (*Populus nigra* L.), to the fruit-borer *Alcides willcocksi* Pic infesting the fruits of jujube (*Ziziphus spina-christi* (L.) Willd.), and to the leaf-miner *Hypurus bertrandi* Perr. mining in the leaves of purslane (*Portulaca oleracea* L.). The adult *Alcides willcocksi* Pic and its variety *testaceipes* Pic were described from Egypt, in 1913. As to *Hypurus portulacae* Hust., it is also described from Egypt, in 1926. Moreover, Alfieri (1936) bred it on purslane together with another weevil, *Baris* (*Aegyptobaris*) *arctithorax* Pic. However, according to H. Wagner (1937), it appears that *Hypurus portulacae* Hust. is but a synonym of *Hypurus bertrandi* Perr. described in 1852.

Rhyncolus cylindrus Boh.

Full-grown larva 3.5-4 mm. long and 1-1.5 mm. broad in its widest part, i.e. the middle of the third thoracic segment.

Pearly-white in colour, moderately stout, sub-circular in cross-section, strongly convex dorsally, much less ventrally. Whole cuticle covered with extremely fine, sclerotised spines (asperities). Pronotum and prosternum provided with a sclerite which covers almost the entire tergite. Both protergal and prosternal sclerites are pale in colour. There is a chitinous ring around the whole anterior margin of the prothoracic segment. Spiracles (Fig. 1 B) bicameral (biforous) and situated on the prothorax and the first eight abdominal segments. The anus is a small transverse cleft at the posterior end of the tenth abdominal segment. Thoracic and abdominal segments with setae as shown in Figure 1 A.

Head brown to dark brown, deeply retracted into the thorax, its shape and setae as shown in Figures 1 C and 1 D ; ocelli not obscured. Antenna (Fig. 1 E) composed of one bristless sensorial cone and a basal membrane, bearing three small bristles. Both mandibles (Figs. 1 F and 1 G) more or less similar, provided with an apically produced tooth and with two large teeth at the inner edge ; molar parts flat and blunt ; dorsal side ridged, underneath with two long setae and two sensillae. Epipharynx with setae as shown in Figure 1 H, provided with two stout long rods extending to nearly the middle of the clypeus. Maxillary palp two-segmented, with a palpiger and labial palp two-segmented but deprived of palpifer. Maxilla and labium with setae as shown in Figure 1 I.

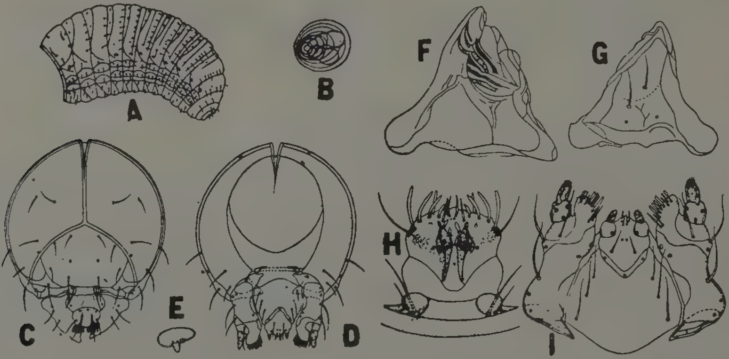

Fig. 1 : Full-grown larva of *Rhyncolus cylindrus* Boh. (A, cuticle, x 7.5 ; B, spiracle, x 230 ; C, dorsal view of head-capsule, x 32.5 ; D, ventral view of head-capsule, x 32.5 ; E, antenna, x 150 ; F, dorsal view of left mandible, x 80 ; G, ventral view of left mandible, x 62.5 ; H, epipharynx x 100 ; I, ventral view of labium, x 67.5).

Alcides willcocksi Pic

Full-grown larva 6-7 mm. long and 2-2.5 mm. broad.

Pearly-white in colour, moderately stout, sub-circular in cross-section, strongly convex dorsally, much less ventrally. Cuticle covered with fine sclerotised spines. Pronotum covered with a light brown sclerite and provided with a chitinous ring around the anterior margin of the prothoracic segment. Spiracles (Fig. 2 B) biforous and situated on the prothorax and the first eight abdominal segments (the ecdysis opening of each spiracle of the previous instar is seen in the Figure beside the air-tubes of the spiracle). The anus is a small transverse cleft at the posterior end of the abdomen. Thoracic and abdominal segments with setae as shown in Figure 2 A.

Head light brown, retracted in the prothorax, its shape and setae as shown in Figures 2 C and 2 D, and with one ocellus on each side. Antennae (Fig. 2 E) represented by one bristless sensorial cone and a basal membrane, carrying three very small bristles. Mandible (Figs. 2 F and 2 G) provided with an apically produced tooth and a large central tooth at the inner edge : molar part more or less flat and blunt ; dorsal side with two long setae and three sensillae. Epipharynx with setae as shown in Figure 2 H, and provided with two short stout rods extending to nearly the posterior margin of the labrum. Maxillary palp two-segmented and bearing a palpiger, labial palp also two-segmented but deprived of palpiger. Maxilla and labium with setae as illustrated in Figure 2 I.

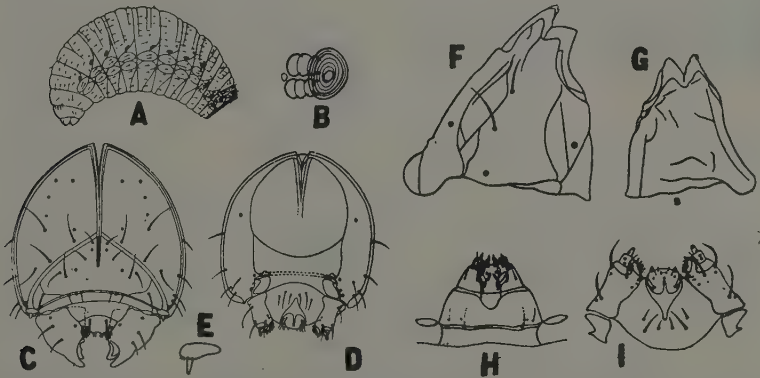

Fig. 2 : Full-grown larva of *Alcides willcocksi* Pic (A, cuticle, x 3.5 ; B, spiracle, x 20 ; C, dorsal view of head-capsule, x 25 ; D, ventral view of head-capsule, x 22.5 ; E, antenna ; F, dorsal view of left mandible, x 100 ; G, ventral view of left mandible, x 70 ; H, epipharynx, x 65 ; I, ventral view of labium, x 30).

Hypurus bertrandi Perr.

Full-grown larva 3.5-4 mm. long and 1-1.5 mm. broad.

Whitish in colour, stout, convex dorsally, almost flat ventrally. Whole cuticle covered with fine sclerotised spines. Pronotum covered with a sclerite almost black. Chitinous ring around anterior margin of the prothoracic segment present. Spiracles situated on the prothorax and the first eight abdominal segments unicameral (Fig. 3 B) except the last abdominal one which is bicameral (Fig. 3 C). The anus is a terminal transverse cleft.

Head blackish, deeply retracted into the thorax, shape and setae as shown in Figures 3 D and 3 F, each side provided with two ocelli, the dorsal one smaller. Antennae (Fig. 3 E) represented by a single bristless sensorial cone, and a basal membrane bearing six very small sensorial cones. Mandible (Figs. 3 G and 3 H) with one apical tooth and the inner concave and finely serrated ; molar part more or less flat and blunt ; dorsal side provided with some ridges, the median one serrated ; there are also three setae and two sensillae. Epipharynx with setae as shown in Figure 3 I, and provided with two rods extending to nearly the anterior third of the clypeus.

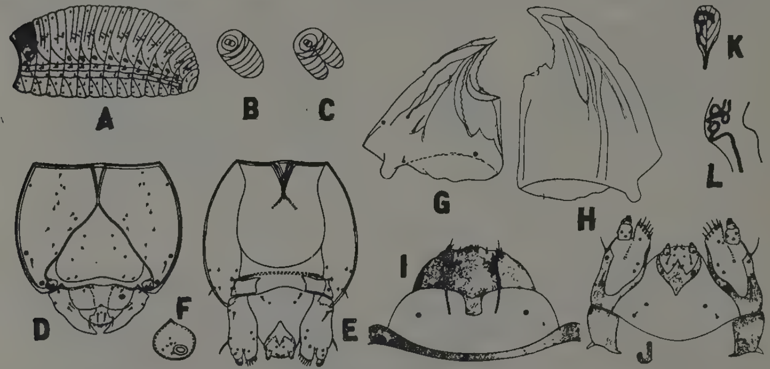

Fig. 3 : Full-grown larva of *Hypurus bertrandi* Perr. (A, cuticle, x 7.5 ; B, seventh abdominal spiracle, x 250 ; C, eight abdominal spiracle, x 250 ; D, dorsal view of head-capsule, x 60 ; E, ventral view of head-capsule, x 55 ; F, antenna, x 350 ; G, dorsal view of left mandible, x 150 ; H, ventral view of left mandible, x 182.5 ; I. epipharynx, x 127.5 ; J. ventral view of labium, x 72.5). — K. linear mine produced by *Hypurus bertrandi* Perr., x 0.375 ; L. larval frass in mine of *Hypurus bertrandi* Perr., x 0.375.

Maxillary and labial palps two-segmented. Palpiger and palpifer missing. Maxilla and labium with setae as shown in Figure 3 J.

The mine (Fig. 3 K) of *Hypurus bertrandi* Perr. is linear and silvery white in colour, and occurs on any part on the upper surface of the blade, including midrib and other veins. All tissues between upper and lower epidermis of the leaf are eaten by the mining larva. Larval frass is deposited in thread in the mine channel as shown in Figure 3 L. Pupation takes place outside the mine, in a cocoon.

SUMMARY AND CONCLUSION

(1) The external morphology of three weevil larvae, is given.

(2) The mandible shows great adaptation to the kind of plant-tissue in which the larva bores. The mandible of the wood-borer has more teeth and

a ridged surface, while in the leaf-miner which lives in flat cells, the inner edge of the mandible is finely serrated in order to work like a saw which cuts up the cells.

(3) The three larvae possess prothoracic sclerites which, as Hering (1951) states, increase the larvae's pressure when they penetrate into the plant-tissu, and also protect the sensitive internal organs lying below. The wood-borer, as it lives in harder tissue, possesses another sclerite covering the prosternum.

ACKNOWLEDGMENTS

We wish to thank Mr. A. Alfieri, the Honorary Secretary General of the Entomological Society of Egypt, for identifying the species dealt with in this paper, and for his kind help during the progress of this work.

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On some Dipterous leaf-miners from Egypt

(with 5 Text-Figures)

MANN

by S.M. Hammad, Ph.D. (Bristol),
Faculty of Agriculture, Alexandria University.

1. Liriomyza trifolii Burgess (=*congesta* Becker [Agromyzidae].

Host plants: Broad bean (*Vicia faba* L.), and peas (*Pisum sativum* L.).

Nature of damage: Linear mine (Fig. 1), light green in colour ; in *Vicia faba* L., it turns to reddish-brown. Infestation occurs on the upperside of the leaf, on any part of the blade. The midrib and other leaf veins are also attacked. Larvae feed on palissade tissue of the leaf and pupate outside the mine. Arrangement of larval frass in the mine channel is shown in Figure 5 A.

Liriomyza trifolii is an oligophagous species and attacks almost all Leguminosae (Hering).

2. Agromyza nana Mg. [Agromyzidae].

Host plant: Egyptian clover or Berseem (*Trifolium alexandrinum* L.).

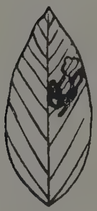
Nature of damage: Linear blotch-mine (Fig. 2), consisting of a narrow track which enlages into a blotch, and silvery-white in colour. It occurs on the upper side on any part of the leaflet, the midrib and other veins being also attacked. Larvae feeds on all tissues between upper and lower epidermis of the leaf, and pupates outside the mine. Arrangement of larval frass in the mine channel as shown in Figure 5 B.

This leaf-miner is also an oliphagous species (Hering).

3. Phytomyza atricornis Mg. [Agromyzidae].

Host plants: Berseem (*Trifolium alexandrinum* L.), melilot (*Melilotus indicus* All), milk thistle or hare's lettuce (*Sanchus oleraceus* L.), and turnip (*Brassica rapa* L.).

Nature of damage: A linear mine (Fig. 3), light green in colour, occuring on both the upper and under side of the leaf on any part of the blade. The midrib and other leaf veins are also attacked. Larvae feed on palissade tissue of the leaf. Pupation takes place inside the mine on either the upper or under surface of the leaf. Larval frass is deposited separately and distinctly in one row on each side of the mine channel as shown in Figure 5 C (Hering stated that, the grains of frass of this leaf-miner are usually separate and lie alternately on the left and right sides of the mine channel, and that sometimes, the frass may be deposited in threads).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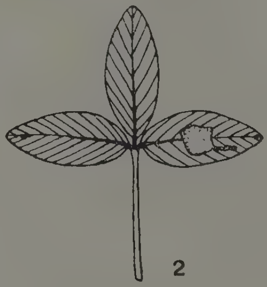
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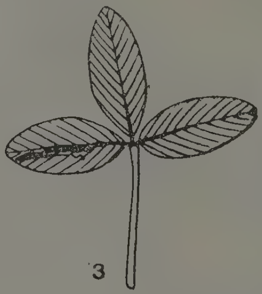
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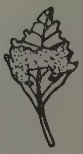
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Fig. 1 : Linear mine of *Liriomyza trifolii* on *Vicia faba.* — Fig. 2 : Linear blotch mine of *Agromyza nana* on *Trifolium alexandrinum.* — Fig. 3 : Linear mine of *Phytomyza atricornis* on *Trifolium alexandrinum.* — Fig. 4 : Blotch mine of *Pegomyia betae* on *Chenopodium murale.* — x 0.65.

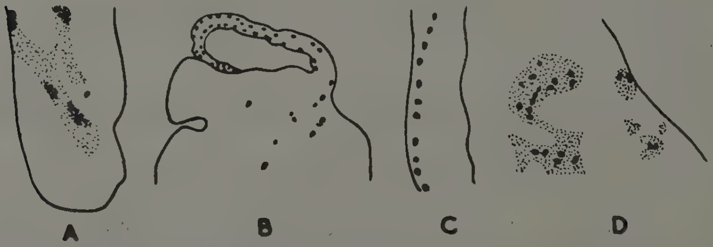

Fig.5 : Disposal of larval frass in mine of (A) *Liriomyza trifolii* on *Vicia faba,* (B) *Agromyza nana* on *Trifolium alexandrinum,* (C) *Phytomyza atricornis* on *Trifolium alexandrinum,* and (D) *Pegomyia hyoscyami betae* on *Chenopodium* murale. — x 5.

According to Hering, this leaf-miner is the commonest poliphagous species. It attacks herbaceous plants, ornamental flowers, and plants in green houses, and may be found on all dicotyledons. It is cosmopolitan and occurs throughout the world, wherever flowering plants are found. Its morphology and biology has been described by Melis.

4. Pegomyia hyoscyami betae Curtis [Anthomyidae].

Host plants: Beet (*Beta vulgaris* L.), leaf beat (*Beta vulgaris ciclu* L.), spinach (*Spinacia oleracea* L.), goosefoot or pigweed (*Chenopodium murale* L.).

Nature of damage: A blotch-mine (Fig. 4), silvery-white in colour, occuring on any part and on both sides of the leaf blade. Midrib and other leaf veins are also attacked. The larva feeds on all tissues between upper and lower epidermis of the leaf. Pupation takes place outside the mine. Arrangement of larval frass inside the mine channel as shown in Figure 5 D.

It is the worst pest in central Europe where it reduces considerably the yield of sugar from the beet, and also affects the development of the young beet plants (Hering). It is also widely distributed in the United States and Canada, but causing less damage than in Europe (Metcalf and Flint). According to its economic importance, this pest has been studied by many authors, such as Forbes, Cory, Wilke, Kleine, and Trouvelot.

Pegomyia hyoscyami betae Curtis is parasitised by *Biosteres spinaciae,* a Braconid wasp.

SUMMARY

Four dipterous leaf-miners from Alexandria were recognized and their mines described. They can be easily identified by the characteristics of their mines and by the arrangement of their larval frass in the mine channel. Illustrations are given.

ACKNOWLEDGMENTS

I wish to thank Prof. E. M. Hering, Zoologisches Museum der Humboldt Universität, Berlin, for identifying the specimens. Also to Mr. A. M. Kolkaila, Faculty of Science, Alexandria University, for cutting the sections in the mined leaves. My thanks are due also to Prof. S. Sakr and Dr. M. A. Moursi, Vegetable Department, for providing me with every facility to collect the specimens from the Departmental Experimental Farm.

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Studies on
Coccinella undecimpunctata aegyptiaca Rche

II. BIOLOGY AND LIFE-HISTORY

[Coleoptera : Coccinellidae]

(with 19 Text-Figures)

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INTRODUCTION

Though *Coccinella undecimpunctata aegyptiaca* is considered one of the most important Coccinellids in Egypt, yet it was but very poorly studied. As a contribution to our knowledge of this predator, the writer has already published two papers concerning (1) the morphology and anatomy of the adult (1948), and (2) preliminary notes and the morphology of the early stages (see this Bulletin, pp. 251-274). The present work is mainly dealing with its biology, life-history and the real role it plays in controlling some of our agricultural pests.

One of the most important aims of the study is to reveal and determine accurately if this ladybird beetle has any important effect on decreasing the numbers of the eggs and larvae of the Cotton leaf worm, *Prodenia litura* F., in Egypt.

LABORATORY BREEDING

In a previous paper (see this Bulletin, pp. 251-274) the writer described the breeding method of the beetle under laboratory conditions. However, in order to obtain accurate and reliable data, it was found necessary, on many occasions, to breed the insects individually.

The following method was found satisfactory for the individual breeding for experimental studies.

A pair of adult insects, one male and one female, was isolated in a normal oviposition cage. Eggs were transferred to glass vials, 12 × 4 cms. The opening of each vial was covered with a piece of thin muslin which was kept in place by means of a rubber band. The cloth was so thin that the physical conditions inside and outside the vials would be similar. Just after hatching, each first instar larva was isolated singly in a glass vial. Each larva was then provided daily with a number of Aphids which constituted its food supply. This method was used in obtaining many data for this work and proved satisfactory.

HATCHING

Few hours before hatching. the yellow colour of the egg changes to grey owing to the change in colour of the developing larva within the egg. Hatching takes place through an irregular aperture in the chorion at the cephalic end of the egg. This process requires about five minutes at an average temperature 27° C. After hatching, the larvae rest in groups for about one hour after which they crawl out of the cluster of the empty shells. It was noticed that an average temperature of 15° C, the newly hatched larvae do not begin feeding until about one day after hatching. After they have started to feed, the larvae begin to crawl actively over the surfaces of the infested plants.

DURATION OF THE DIFFERENT IMMATURE STAGES

The duration of the different immature stages varies according to temperature. Under laboratory conditions, the incubation period varies from two to three days in summer (May to August) at an average temperature of 27° C, to seven to nine days in winter (December to February) at an average temparture of 15.5° C. In the field, it varies from two to three days in summer (average temperature 29.2° C.), to twelve to thirteen days in winter (average temperature 14.5° C.).

Figure 1 shows the average duration of the different immature stages in the laboratory and in the field at different temperatures.

The longest life-cycle obtained under laboratory conditions was 49 days in winter when the average temperature was 15.5° C., while the shortest was

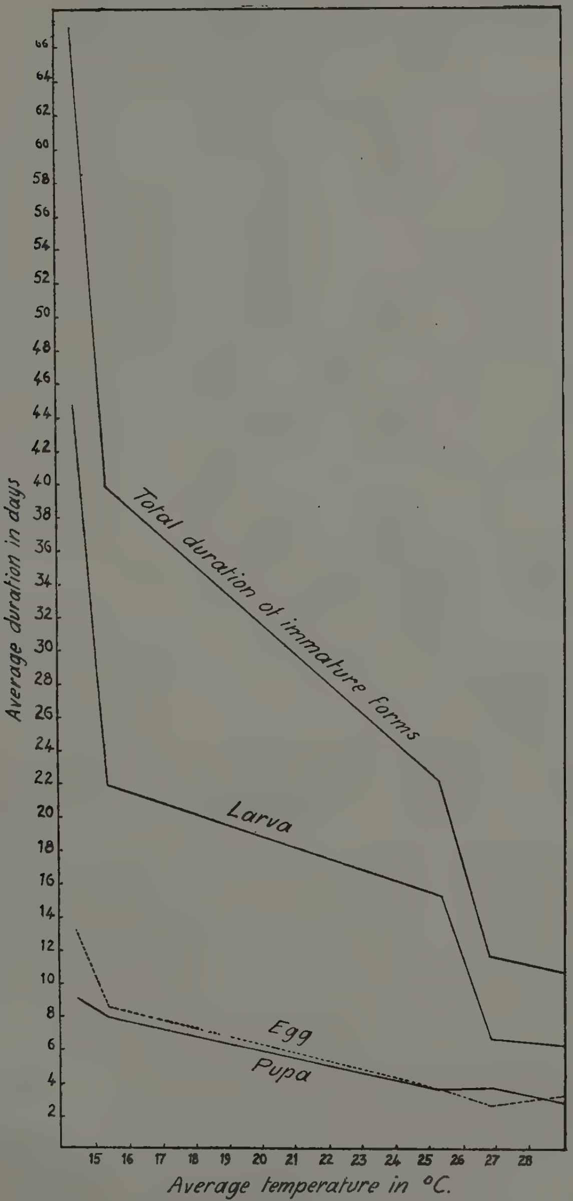


Fig. 1 : Average duration of the early stages at different temperatures.

11 days when the insects were bred at a constant temperature of about 27° C. In the field, the longest life-cycle obtained was 86 days in winter, when the average temperature was 14.5° C, while the shortest was 9 days in summer when the average temperature was 29.2° C.

It may be of interest to note that the range of the life-cycle (i.e. the range between the maximum and minimum cycles) is zero for insects bred at a constant temperature of 27° C. It is eight days for insects bred in partially conditioned room where the range of temperature variation is limited, 7° C. (21-28° C.), and it is seventeen days for insects bred in an unconditioned room where the range of temperature variation is greater, 9.5° C. (10-19.5° C). In insects bred in the field in summer time, the range in life-cycle was five days, when the range of temperature variation was 23° C. (17-41° C.), while in insects bred in the field in winter time the range in the life-cycle was 34 days when the range of temperature variation was 25° C. (0-25° C.).

Thus the ranges in the life-cycle were 5, 0, 8, 17 and 34 days when the insects were bred at 29.2, 27, 25.5, 15.5, and 14.5° C. respectively. It seems therefore that :

1. Within certain temperature limits there is a kind of correlation between the average temperature and the range of temperature variation and the range in the life-cycle of the beetle.

2. The lower the average temperature and the greater the range of temperature variation the greater the range in the life-cycle. How much of this correlation is due to the average temperature and how much is due to the range of temperature variation is difficult to find out from the results of this experiment.

FEEDING CAPACITY OF THE DIFFERENT LARVAL STAGES

Twenty newly hatched larvae were isolated singly in glass vials at an average temperature 25.5° C. in the laboratory. Every glass vial was covered by a thin muslin tissue kept in place with a rubber band. Each larva was provided daily with a large and definite number, more than sufficient, of two-thirds grown *Aphis durantae.* This size was found convenient in this experiment and in all feeding experiments carried out in this work since it was easy to observe and was not in a stage of reproduction, thus avoiding that the larvae or adults might feed on the progeny produced by the full-grown Aphids which would certainly confuse the results.

The number of live Aphids present in the vials was determined at the corresponding time the following day and substracted from the original number to get the number of Aphids consumed per larva during the preceding twenty four hours. The exuvia were credited to the day on which they were removed. A similar experiment was set up in the field during January and February 1950, when the average temperature was 14.5° C.

The results of the above experiments indicate that :

1. Irrespective of the physical conditions and the duration of the larval stage, the amount of food consumed by the larva to develop normally is nearly the same. It is on the average 419 Aphids for larvae placed in the laboratory and 458 Aphids for larvae placed in the field. The average temperature in the first case being 25.5° C., and in the second case being 14.5° C. The average duration of the larval stage being 13.5 and 45 days respectively.

2. On the other hand the daily rate of food consumption varies with temperature. It is on the average 30.4 in the first group where the larvae were placed at an average temperature of 25.5° C., while it is 10.3 in the second group where the larvae were placed at an average temperature of 14.5° C.

3. The number of Aphids consumed during each of the four larval instars does not seem to vary significantly in the two groups. The numbers consumed during the four instars in the case of the first group (laboratory) are on the average 27.1, 51.6, 70.1 and 270.5 respectively. Those in the case of the second group (field) are on the average 28.3, 53.8, 90.5 and 286.3 respectively. The average of the daily rate of food consumption do change, however, in the two groups. They are 8.7, 18.2, 28.3 and 55.7 respectively in the first group and 4.8, 4.7, 7.8, and 20.9 respectively in the second group.

4. It is noted that the changes in the averages of the daily rate of food consumption of the different instars are much more pronounced in the first group than in the second group which does not show much significant change especially between the first and second instars.

5. In both groups, the amount of food consumed is successively greater at each succeeding instar. It is lowest in the first larval instar and greatest at the fourth larval instar. In the first group, the amount of food consumed in the second instar is 1.9 time the amount consumed in the first instar. The amount consumed in the third instar is 0.9 time the amount consumed during the previous two instars. The amount consumed during the fourth instar is 1.7 the amount consumed during all the previous three instars. In the second group, these figures are 1.9, 1.1 and 1.6, respectively, or almost the same as in the first group.

6. In the first group, the increase in amount of food consumed at any particular instar than in the preceding one is due to the increased feeding activity of the larva at the succeeding instar. This is indicated by the successive increase in the average of daily rate of consumption.

7. In the second group the increase in the amount of food consumed at any particular instar than in the preceding instar is not necessarily due to the increased feeding activity of the larva at the succeeding instar. This is

especially true for the first two instars where the increase in the amount of food consumed in the second instar than in the first instar is rather due to its longer duration period.

8. In insects placed in the field, it is noticed that prior to each moult the larva either feeds very little or ceases to feed altogether. In the laboratory, where the average temperature is comparatively higher this phenomenon is not so clearly noticed owing to the fact that the duration of each instar under laboratory conditions is remarkably much shorter as compared to that in the field, and that high temperature stimulates the larva to consume a larger quantity of Aphids in a shorter period. These results are shown in Figure 2.

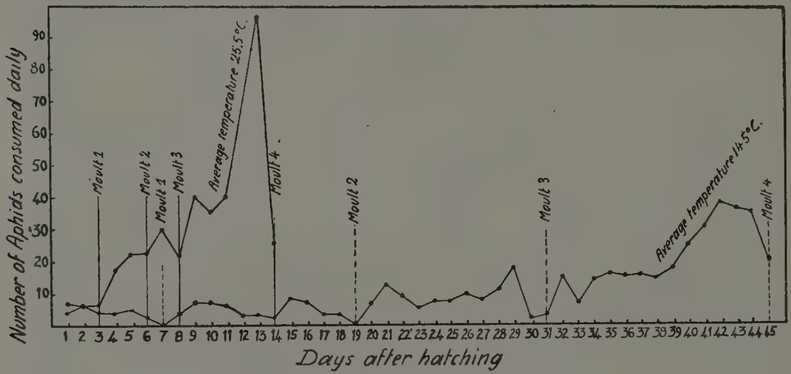


Fig. 2 : Daily food consumption of two average-sized larvae reared in both laboratory and field.

EFFECT OF AMOUNT OF FOOD CONSUMED IN THE LARVAL STAGE ON THE DURATION OF THE LARVAL AND PUPAL STAGES

An experiment was carried out to determine the effect of the quantity of food consumed during the larval stage of the beetle on the duration of the larval and pupal stages. The experiment was designed as follows :

Sixteen groups of newly hatched larvae, of ten larvae each, were used. The larvae in the first group were each provided daily with five two-third grown *Aphis durantae,* those of the second group were each provided with ten Aphids daily and so on until those in the sixteenth group were each provided daily with eighty Aphids. Observations were made daily and exuvia were removed. The moult was credited in each case to the day upon which the exuvium was removed, as it was impracticable to make observations corresponding to fractional days. The date of pupation was considered the day on which the larva attached itself to a substratum and assumed the general appearance of the pupa. The larvae in group one, which were given each five Aphids daily, failed to complete their development and died during the

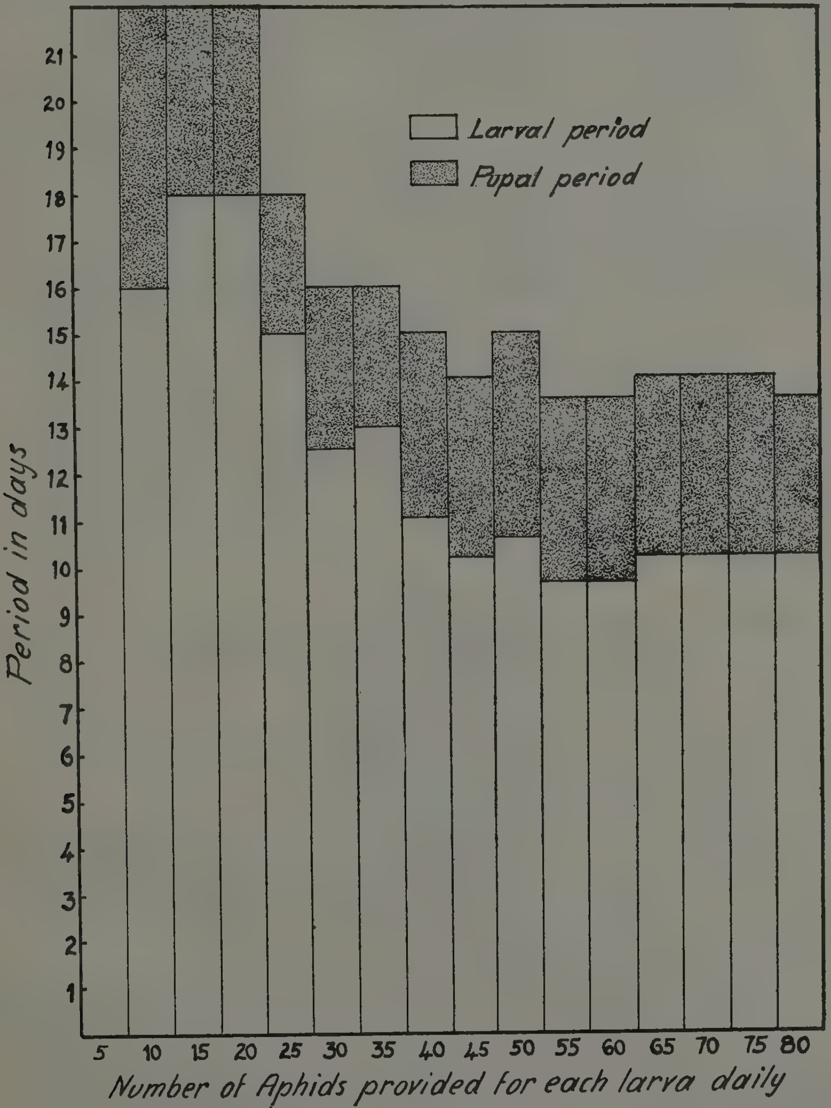


Fig. 3 : Relation between the amount of food consumed during the larval stage, and duration of larval and pupal stages.

last larval instar. Similarly, the larvae in group two which were given each ten Aphids daily, failed to complete their development with the exception of one larva which gave emergence to an adult. This adult insect, however, was significantly very small. All the larvae in the other groups were able to grow and to complete their development. The results of this experiment are shown in Figure 3, and indicate that :

1. Generally, at least 15 two-third grown *Aphis durantae* should be provided daily for each larva in order to be able to complete its development.

2. The duration of the larval stage is affected by the amount of food consumed during this stage up to a certain point. There is a general gradual decrease in the duration of this stage from 18 to 10 days with the increase in the daily amount of food consumed per larva from 15 to 45 Aphids. Any further increase in the amount of food consumed daily per larva does not seem to have any bearing on the duration of this stage.

3. The duration of the pupal stage does not seem to vary with the increase in the amount of food consumed during the larval stage from 15 to 80 Aphids per day, for each larva.

4. The duration period of the larval and the pupal stages depends on the amount of food consumed during the larval stage up to a certain point. The increase in the amount of food consumed daily per larva has the same general effect on the duration of this period as on the duration of the pupal stage.

EFFECT OF AMOUNT OF FOOD CONSUMED DURING THE LARVAL STAGE ON THE SIZE OF THE ADULT BEETLES

The length and width at the widest part of each adult bred in the previous experiment were measured and averaged for each group. The results given in Figure 4 indicated that :

1. There is a general gradual increase in the length of adult beetle with the increase in the amount of food consumed during the larval stage up to a certain point. There is an increase in length from 2.9 to 4.9 mm. with the increase in the amount of food provided daily to each larva from 10 to 60 Aphids. Any further increase in the amount of food consumed does not seem to have any effect on the length of the insect.

2. There is a general gradual increase in the width of the adult insect with the increase in the amount of food consumed during the larval stage up to a certain point. There is an incerase in width from 2.00 to 3.00 mm. with the increase in amount of food consumed per larva per day from 10 to 40 Aphilds. Any further increase in the amount of food consumed does not seem to have a significant effect on the width of the adult.

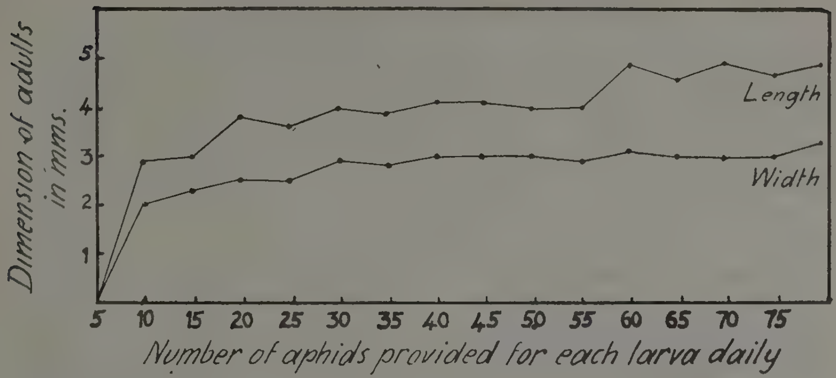


Fig. 4 : Relation between the number of Aphids consumed daily by larvae and the average size of the adult beetles.

EMERGENCE

The pupa normally attaches its posterior end to the exuvium of the last instar larva which is always fixed to some kind of a solid substratum. When about to emerge, the adult insect forces itself out of the pupal skin through a T-shaped slit at the anterior most end of the pupa (Fig. 5). Through the movements of the legs and wings the insect at last succeeds in extricating itself from the pupal skin leaving it as an empty shell. Immediately after emergence the elytrae look light yellow in colour withtout marked dotting. A short time later, the regular number of black dots which characterize the elytrae of the adult insect begin to form. The insect is now ready to move and to start its activities. Under laboratory conditions males and females emerge at about the same time.

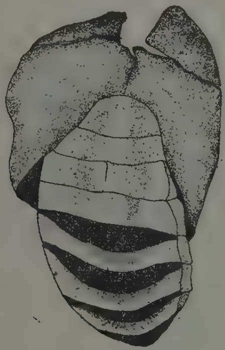


Fig. 5 : Pupal skin after emergence of the adult, × 11.

SEX RATIO AT DIFFERENT SEASONS

By counting the number of females and males in a population of 1482 adults collected in the field, it was found that 687 of them were males and 795 were females. This is a sex ratio of about 1:1. The same ratio was generally obtained whenever large numbers of the insects were collected in the field at any time of the year.

MATING

Mating is accomplished by the male mounting on the back of the female while resting its hind legs on some kind of solid substratum, its fore legs embracing the female around the middle part of its body. The male bends its posterior part ventrally and anteriorly to insert its aedeagus in the female genital opening. The two insects then rest quietly. From time to time, however, about every two minutes or so, the male trembles violently. Sometimes the female walks around during the process with the male on her back. The whole process lasts on the average about six minutes with a maximum of fifteen minutes and a minimum of one minute under laboratory conditions at a temperature of 22° C.

It was noticed that day light stimulates the beetle to mate. This phenomenon was made use of to induce mating in laboratory bred insects. Mating, however, may take place outdoors and in the laboratory in the shade. Usually the beetles begin to mate in less than twenty four hours after emergence. Both males and females mate more than once throughout their life time. The male mates more than once either with the same female or with different females. The maximum number of copulations between a certain couple was found to be three. In this case the female lived for 137 days while the male lived 135 days. The minimum period between two successive copulations of a certain couple was found to be twenty four hours under laboratory conditions at an average temperature of 22° C.

THE PRE-OVIPOSITION PERIOD

The pre-oviposition period varies with temperature being about two to four days in summer when the average temperature is 29° C., and twelve to fourteen days in winter when the average temperature is 14° C. When females were kept in an incubator at a constant temperature of 27° C., the pre-oviposition period was always two days. There is a remarkable difference in the pre-oviposition period of mated and unmated females. In an experiment carried out in the field in January 1951, ten mated and ten unmated females were used. They were isolated singly in twenty glass vials, placed in the field and examined from time to time. The average pre-oviposition period of mated females was about 13 days, while the average period of unmated females was about 48 days.

OVIPOSITION

During the process of oviposition, the terminal segments of the abdomen were observed to extend until the tip of the abdomen was as close as possible to the surface of the substratum when the female sticked one egg to it. The interval between the deposition of two successive eggs varied from 20 to 30 seconds. In confinement eggs were sometimes laid on wooden walls, wire screens, glass walls, cloth, plant sprigs and other available substrata in the cage. In the field they are mostly laid on the plants, on stems, and on both surfaces of the leaves. Whether in the field or in the laboratory, eggs are always laid among or in close proximity of Aphid colonies. Eggs are laid either separately or arranged in layered clusters. Both mated and unmated females lay eggs. Unfertile eggs shrink and collapse few days after deposition. While fertile eggs of mated females are in most cases deposited in compact generally large regularly arranged clusters (Fig. 6), unfertile eggs laid by unmated females are deposited either singly or in comparatively small loose clusters.

Egg-clusters deposited by mated females vary from 1 to 37 eggs each, while those of unmated females vary from 1 to 15 eggs each. Eggs from mated females are generally laid erect with one end attached to the substratum and the longitudinal axis at right angle to it. Eggs from unmated females are deposited in a haphazard manner mostly laying on one side, the longitudinal axis being horizontal to the substratum.

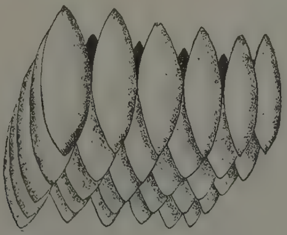


Fig. 6 : Fertile egg-cluster (much enlarged).

With mated females, the maximum number of eggs laid per day by a single female is 89, while the maximum number of egg clusters is 4. With unmated females these figures are correspondingly 50 and 45.

EFFECT OF DIFFERENT FACTORS ON FECUNDITY

Several factors, such as temperature, amount of food, diet, and copulation, were noticed to affect the rate and amount of egg production.

Several experiments were carried out to determine the effect of each of the above mentioned factors. Because of the cannibalistic habits of the adults, it was found necessary, in order to secure accurate data, to look for and to remove the eggs at least twice daily.

Temperature

An experiment was set up to determine the effect of temperature on fecundity. Thirty females which emerged on December 15th, 1950, were divided into three groups of ten females each. Each female was placed with

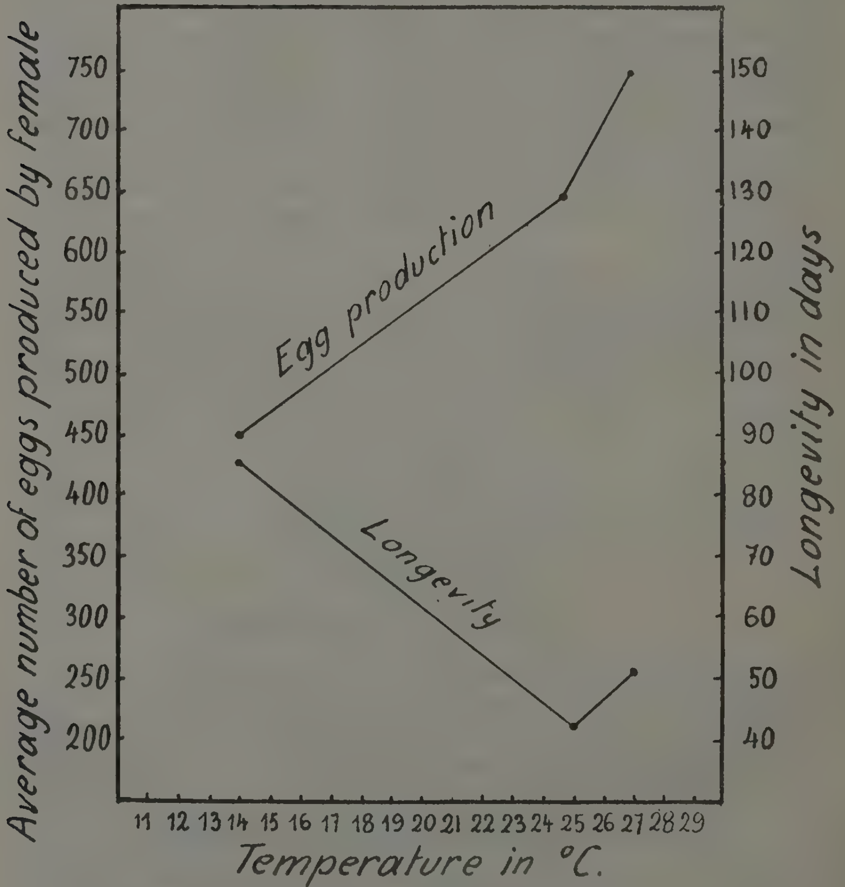


Fig. 7 : Effect of temperature on egg-production and longevity.

one male in a glass vial and was provided daily with sufficient numbers of *Aphis durantae.* Each group was placed separately, either (1) in an incubator with a constant temperature of 27° C, (2) in a conditioned room with an average temperature of 25° C, and (3) in the field with an average temperature of 14° C.

The results of this experiment are recorded in Figures 7 and 8.

It is concluded, from the experiment that :

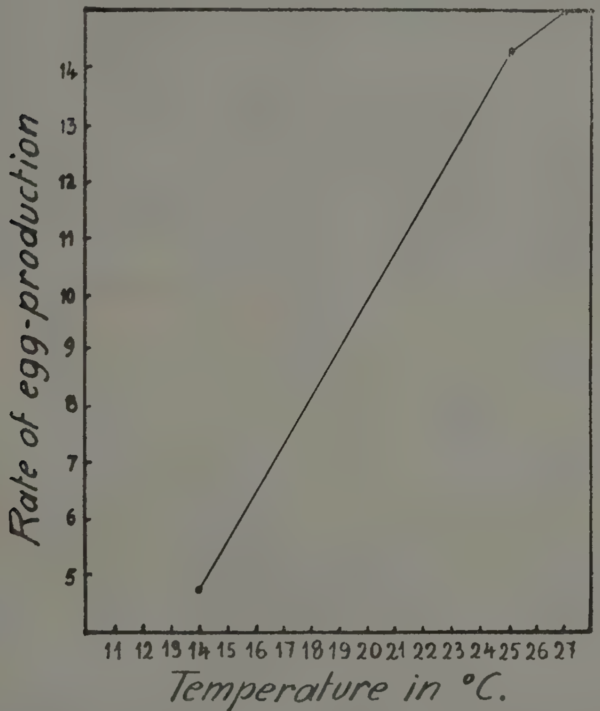


Fig. 8 : Effect of temperature on the rate of egg-production.

1. Within a range of temperature between 14° C. and 27° C., there seems to be a general positive correlation between the temperature and number of eggs laid. While the average number of eggs laid per female was 746 among females kept at a constant temperature of 27° C, it was 653 among females kept in an average temperature of 25° C., and 451 among females kept in the field where the average temperature was 14° C.

2. The rate of eggs production (the average number of eggs daily laid) shows also a general positive correlation being 15 among insects kept at

27° C., 14.2 among insects kept at 25° C., and 4.7 among insects kept at 14° C. The increase in longevity among insects kept at low temperature does not seem to offset the effect of high temperature on increased rate of oviposition.

Amount of food

150 newly emerged and mated females were divided into fifteen groups of ten females each. Each female was placed separately in a glass vial with a piece of cotton wool soaked with water and provided daily with a certain amount of *Aphis durantae.* Females in group 1 were allowed 5 Aphids daily each, females in group 2 were allowed 10 Aphids daily each, females in group 3 were allowed 15 Aphids daily each, and so on until females in group 15 were allowed 75 Aphids daily each. From time to time, one male was introduced to each female to effect mating. The number of eggs deposited daily by each female was counted and the results are shown in Figure 9.

It is concluded from this experiment that :

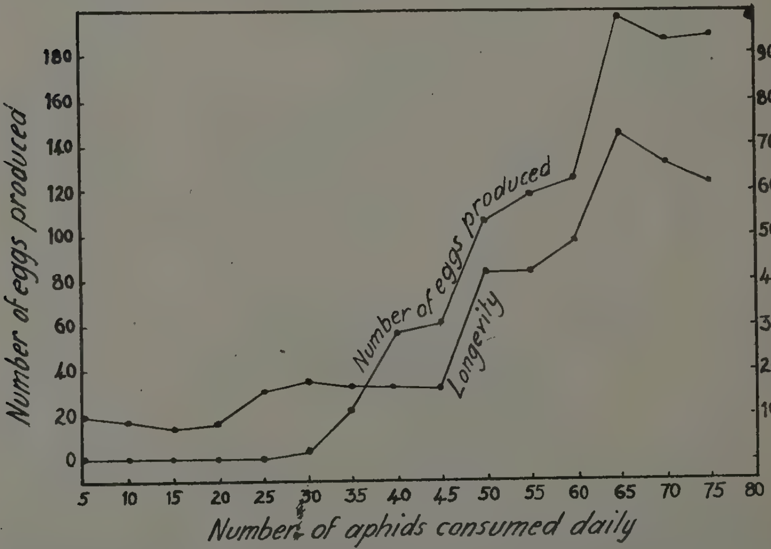


Fig. 9 : Effect of daily consumption of Aphids by adults on egg-production and longevity.

1. A female must feed daily on a minimum average number of 30 two-third grown *Aphids durantae* before it lays any eggs. Females fed on smaller number of Aphids do not only fail to oviposit, but fail to show any fully

developed eggs in their ovaries as revealed by dissection. Such females live on the average shorter than those which are better fed.

2. The number of females in each group which succeeds in laying any eggs seems also to depend on the amount of food consumed, being zero among females fed on 25 or less Aphids daily each, 2 among females fed on 30 Aphids daily each and 4 among females fed on 35 Aphids daily each. Females in these two last groups were, however, poor producers. The maximum number of eggs laid per female in these two groups were successively 12 and 70 per day. An average minimum of 40 Aphids daily seems necessary for average females to lay any eggs.

3. Up to a daily allowance of 65 Aphids per female there is generally a positive correlation between the quantity of food consumed and longevity and egg production. The greater the amount of food consumed, the larger the number of eggs laid and the longer the longevity. Above this level, the increased food consumption seems to have almost no effect on the egg production. As for the downward trend in longevity above this level, it needs more work to be explained.

Diet

Five groups of ten couples each were isolated in pairs in glass vials. Couples in each group were given sufficient quantities of a certain kind of food with the purpose of determining the effect of the kind of food on egg production. Diet was (1) *Aphis durantae*, (2) *Phenacoccus hirsutus*, (3) *Prodenia litura* eggs, (4) newly hatched larvae of *Prodenia litura*, and (5) droplets of honey and water.

The results of this experiment indicate that only females feeding on Aphids succeeded in laying the normal quantity of eggs. All females in the other groups failed to lay any eggs or show any fully developed eggs in their ovaries as revealed by dissection.

With the exception of Aphids, other diet do not seem to be either attractive or nutritious enough for the beetle to produce any eggs. The beetle may be sustained for some time on some of these foods and even for several months on some others but still fail to produce any eggs.

In another experiment, ten couples of newly emerged adults were allowed to feed on honey and water from May 15th to September 2nd, 1951, but failed to develop any eggs. On September 2nd, eight couples were still alive and were divided into two groups, four couples each. One group was provided with *Aphis durantae* while the other group continued feeding on honey and water. The four females in the first group began to deposit eggs, 3, 5, 9, and 10 days respectively after changing their diet, while the females in the other group did not deposit any eggs until they died in October. The numbers of eggs laid by the first four females were 242, 204, 62, and 51 respectively.

This experiment lends further support to the opinion expressed previously that oviposition in *Coccinella undecimpunctata* takes place only after feeding on Aphids.

Copulation

An experiment was carried out to determine the effect of copulation on the number of eggs deposited per female and on the rate of oviposition.

Fourty newly emerged females were divided into two groups of twenty females each. In one group the virgin females were isolated singly in glass vials. In the other group each female was placed with a male in a glass vial. Each group was then divided into two sub-groups of ten females each. One sub-group from each group was placed in the incubator at constant temperature of 27° C. The other two sub-groups were placed in the field at an average temperature of 14° C. The insects were provided all the time with sufficient numbers of Aphids. The results of the experiment are shown in Figure 10, and indicate that :

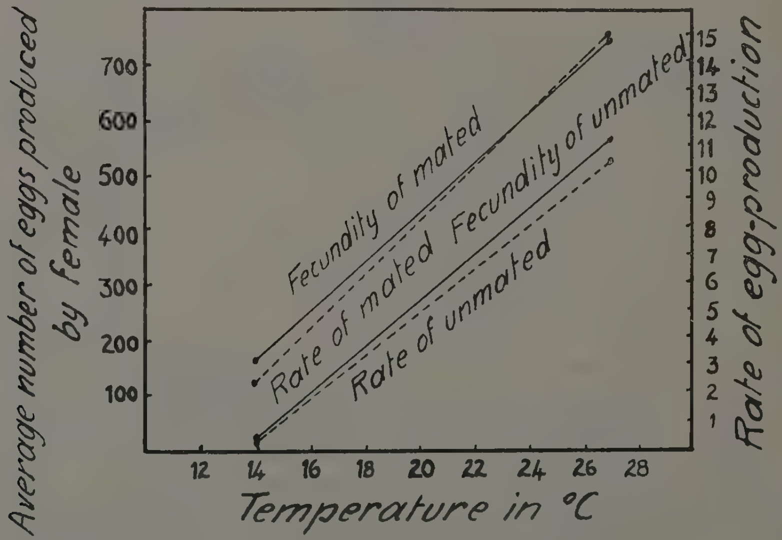


Fig. 10 : Effect of copulation on egg-production in the field and in the laboratory.

1. On the average mated females lay more eggs than unmated females. At 27°C., the average number of eggs laid by a mated female is 746, while

the average number laid by unmated female is 563. At 14°C., the same principle holds true. The average number of eggs laid by a mated female is 167 while the average number laid by unmated female being 21.

2. The average rate of egg production is higher among mated females than among unmated females. At 27° C., the average rate is 15 and 10.6 among the mated and the unmated females respectively, while these averages are 2.4 and 0.3 respectively among females placed at an average temperature of 14 ° C.

3. The effect of copulation on both fecundity and rate of egg-production is more pronounced among females held at varying low temperature with an average of 14° C., than among females held at high constant temperature of 27° C. At constant temperature of 27° C., the average fecundity and the average rate of egg production of unmated females are about 75% and 71% of those of mated females. At a varying temperature averaging 14° C., the figures are correspondingly 12 and 12%. Both egg-fecundity and rate of egg-production seem to be affected to the same degree.

EFFECT OF COPULATION OF ADULT FEMALES ON FERTILITY OF EGGS PRODUCED

Five females that emerged on December 12th, 1950, were copulated on December 15th. Males were then removed and each female was isolated singly in glass vials in the laboratory (average temperature 23° C.) and the number of eggs laid by each female was observed in absence of any further copulation. On December 21st, 1950, the females began to lay fertile eggs. As indicated by the shape of the clusters, the manner the eggs are attached to the substratum and the hatchability of the eggs. They continued to lay fertile eggs until January 28th, 1951, i.e. for a period of 38 days (44 days after copulation). From that date on, the female began to deposit both fertile and unfertile eggs with a sudden increase in the percentage of the unfertile eggs. 47 days after copulation, the average number of eggs laid daily per female was 36 eggs, most of them laid singly and very few in clusters of 2-3 each. On the average, only 11% of these eggs were fertile. 50 days after copulation, only one egg out of 43 eggs laid by one female was fertile, i.e. an average fertility of about 2%. All eggs laid by the females thereafter were sterile, until all females died eight days later.

The same experiment was repeated in the field at an average temperature 14° C. The females were copulated on December 15th, 1950, and continued to lay fertile eggs until they died 108 days later. They ceased egg-laying for an average of three days before they died.

Whether the decline in the percentage of fertile eggs produced by females placed in the laboratory (average temperature 23° C.) is due to depletion of the sperms in the spermatheca of the females or to aging to sperms is beyond the scope of this paper. It may be concluded, however, from the results of this experiment, that one copulation of newly emerged female which is placed at 23° C., is adequate to insure fertilization of all the eggs produced by it for a period of 44 days after copulation. Females placed at lower temperature continue laying fertile eggs for a longer period, though the number of eggs may be the same or less.

LONGEVITY OF ADULTS

The longevity of adults depends upon several factors, the most important of which are the quantity and quality of food, temperature and to a certain extent sex. Several experiments were carried out to determine the longevity of both sexes of the beetle under different conditions.

Longevity of adults in respect of amount of food consumed

Fifteen groups, ten males and ten females each, of newly emerged adults were used. Insects in each group were isolated singly in glass vials, 12x4 cms. The insects in the first group were provided each with five two-third grown *Aphis durantae* daily, those of the second group each with ten Aphids daily, those in the third group each with fifteen Aphids daily, and so on until those of the fifteenth group were provided each with 75 Aphids daily. The results of this experiment are given in Figure 11 which shows that within the limits of the experiment, the longevity of both males and females generally increases with the increase in the amount of food consumed and

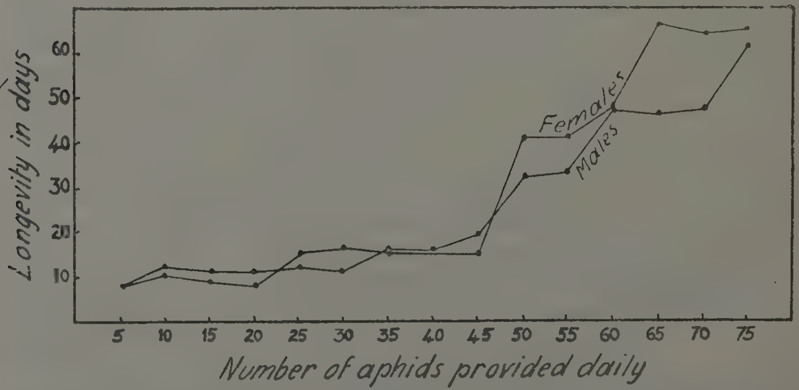


Fig. 11 : Relation of number of Aphids consumed daily and longevity in both males and females.

that the increase of longevity of females proceeds at first at a lower rate than that of males and then proceeds at a more rapid rate. It can be seen that in both males and females, the increase of longevity with the increase in the amount of food consumed does not proceed gradually but rather in sudden significant jumps. There seems to be various food consumption ranges at different successive levels of insect longevity. Within each range the longevity of the insect does not show any significant change with the increase in the amount of food consumed. At the end of each range there is a critical point of food consumption beyond which a slight increase would result in sudden noticeable increase in the longevity of the insect.

The ranges in food consumption for males may be roughly defined as follows: 5, 10-30, 35-40, 45, 50-55, 60-70, 75, with the following corresponding rough levels on insect longevity in days 8, 12, 16, 19, 32, 47 and 61.

For females, the ranges of food consumption may be roughly defined as follows: 5-20, 25-45, 50-55, 60, 65-75, with the following rough levels of insect longevity in days, 9, 15, 41, 48, 65.

Longevity of adults in connection with kind of food

A second experiment was carried out to show the effect of different kinds of food on the longevity of adults. Six groups, ten males and ten females each, were used. The adults in each group were isolated singly in glass vials. The insects of the first group was left without food. Those of the second group were fed on water only, those of the third group were provided with droplets of honey and water only, a piece of cotton wool soaked in water was placed with each insect. Insects of the fourth group were fed on two-third grown *Aphis durantae*, those of the fifth group on two-third grown *Phenacoccus hirsutus,* and those of the sixth group on *Prodenia litura* eggs provided in form of egg-masses of about 50 eggs each.

Under similar laboratory conditions, adult females generally live longer than adult males. The least longevity is obtained when the beetles are starving, the average longevity of the beetles being four days for females and three days for males (average temperature 26° C.). When kept at 14° C., starved beetles lived significantly longer, the average longevity being six days for both males and females.

The beetles live on the average three times as long when provided with water only than when starved, about eight times as long when fed on *Prodenia* eggs or nymphs of *Phenacoccus hirsutus,* about fourteen times as long when fed on *Aphis durantae,* and twenty-one times as long when fed on honey and water. The value of these foods in relation to the longevity of adults could therefore be arranged in the following order : honey and water, *Aphis durantae,* eggs of *Prodenia* or nymphs of *Phenacoccus hirsutus,* water only, no food or water.

The maximum longevity, 142 days for females and 140 days for males, was obtained when the beetles were fed on water and honey. The average longevity on this diet was 104 and 62 days for females and males respectively.

The short longevity obtained when the beetles were fed on *Phenacoccus hirsutus* or on *Prodenia* eggs, seems to be due to their being not attractive enough to the beetles rather than being unbalanced diets.

The long longevity of the beetles which is obtained when they were fed on honey and water diet is of special significance, and explains how adults could sustain themselves in the field during the long summer months when the Aphid population is at a low level. It is interesting to note that during these months, water and nectar are available in sufficient quantities. Cotton blossoms and cotton leaf nectar glands which occur at the mid-rib of cotton leaves are extremely abundant.

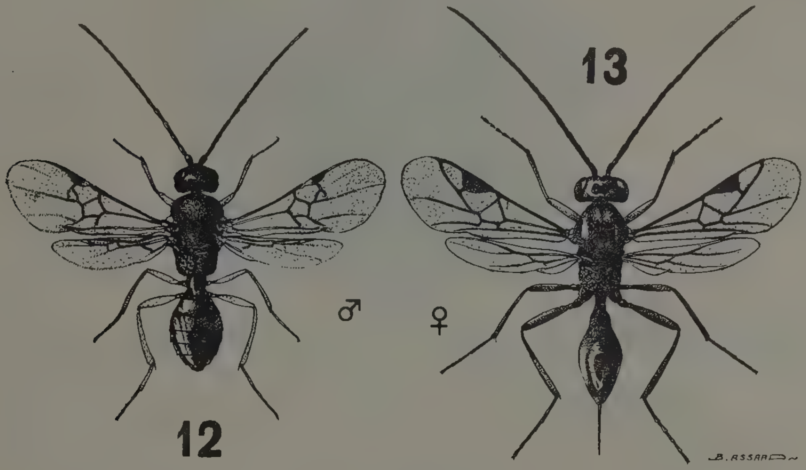
Longevity of adults in relation to temperature

In a third set of experiments designed along the same general pattern of the two previous ones, the relation of temperature to longevity was studied. The insects were provided with sufficient quantity of *Aphis durantae* and each group was kept at a different temperature.

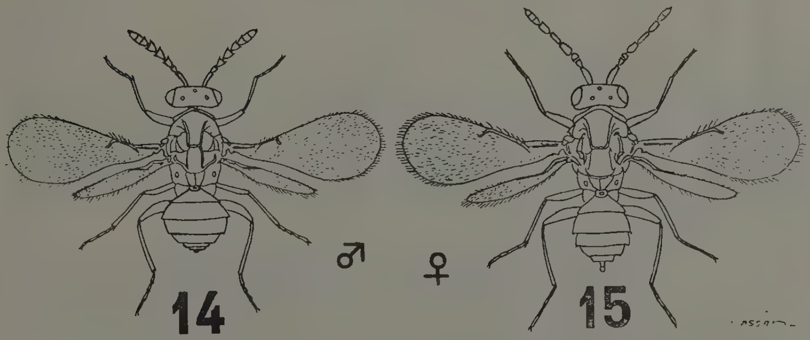
It appeared that (1) under similar field conditions, the longevity of adult insects varies with the average temperature, the average longevity being 37 days for females and 42 days for males in summer when the average temperature is 29.1° C., while it is 62 and 63 days respectively in winter when the average temperature is 14° C; and (2) that there is a regressive correlation between the longevity of adults and the average temperature at which they are kept, the lower the temperature the longer the longevity.

PARASITISM

Two species of parasites, *Perilitus coccinellae* Schr. (Braconidae) (Figs. 12 and 13) and *Tetrastichus coccinellae* Kurdj. (Eulophidae-Tetrastichini) (Figs. 14 and 15) were bred from *Coccinella undecimpunctata* collected in the field. The Braconid is well distributed in Egypt. It emerges from adult beetles. Collections made in the field indicate that the parasite attacks the beetle in the larval, pupal or adult stages. After completing its development, the full grown larva of the parasite makes a hole at the dorsal surface of the abdomen of the adult through which it makes its way out. It spins a small silky oval brownish yellow coccon beneath the body of the host where it pupates (Fig 16). The parasitized beetle, though still alive, moves sluggishly and seems to be unable to coordinate its movements. Its legs get entangled with the cocoon. It stops feeding and moving until it dies one or two days after the issuance of the parasite larva. Parasitism takes place equally in both sexes and only one parasite emerges from each host insect.



Figs. 12 and 13 : *Perilitus coccinellae* Schr., male and female, × 5.



Figs. 14 and 15 : *Tetrastichus coccinellae* Kurdj., male and female, × 10.

3803 adult beetles were collected from the field in the different months of the year. The number of emerging parasites were recorded and the percentage of parasitism for each month was determined.

The result of the experiment is given in Figure 17, which shows that the percentage of parasitism by *Perilitus coccinellae* in the field varies in the different months of the year being comparatively high, reaching a maximum of 6.4% from March until June. In the following months, this percentage drops down but then rises again with the increase in the beetle population in the field, reaching about 3% during November and December.

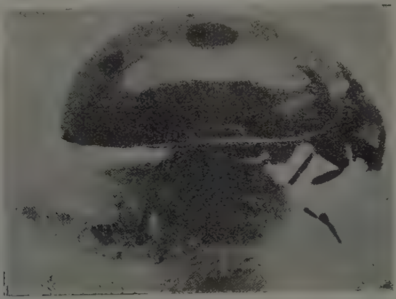


Fig. 16 : Parasitized *Coccinella undecimpunctata* attached to the cocoon of *Perilitus coccinellae* Schr., × 12.

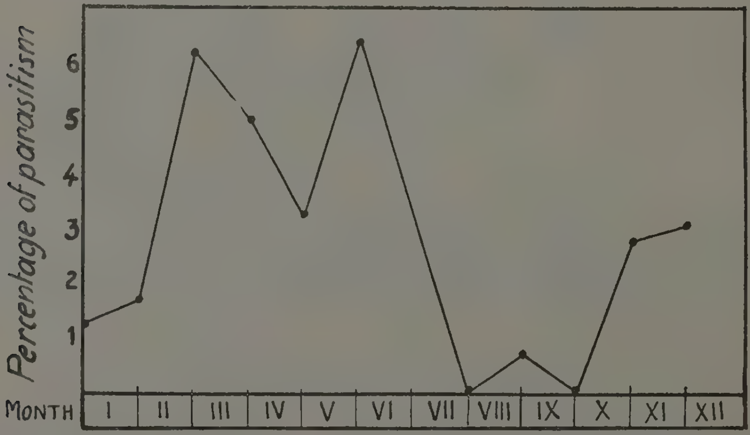


Fig. 17 : Percentage of parasitism by *Perilitus coccinellae* in the field during different months in the year.

A Pteromalid hyperparasite was observed to emerge from the cocoons of *Pertilitus* collected in the field. The percentage is, however, very small, practically of no economic importance.

Tetrastichus coccinellae Kurdj. attacks the last instar larva, the prepupa and the newly formed pupa. The adult parasite emerges from the host pupa through a small hole on the dorsal surface (Fig. 18). From 4 to 18 adult parasites emerge from a single host pupa. Because the parasite has not been collected in large numbers, it is not possible to give accurate information on the percentage of its parasitism. The parasite seems to be well distributed at least in the Delta ; it was bred from host pupae collected at Alexandria and Giza.

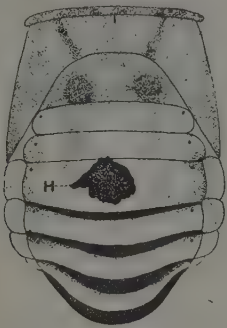


Fig. 18 : Parasitized puparium of *Coccinella undecimpunctata* after emergence of *Tetrastichus coccinellae* Kurdj. (H. exit hole of the parasite), × 10.

SEASONAL HISTORY

The problem of seasonal history of *Coccinella undecimpunctata* in Egypt is controversial. Few authors discussed this problem but without definite conclusion. The number of generations per year is also debatable.

Willcocks (1927) and Bishara (1934) in dealing with the beetle did not discuss the problem of its seasonal history. Kamal (1951) claims that the beetle is most commonly met with in Egypt from March till the end of October. He claims also that the beetle has two distinct generations per year, the first one beginning in March in Upper Egypt and the second one occurring in the latter half of September in Lower Egypt.

The observations and biological studies made by the writer in both field and laboratory indicate that the beetle has two distinct generations.

The eggs of the first generation are encountered in the field from the last week of December until the beginning of March. The peak of egg-clusters occurs about the end of February and the beginning of March. Larvae of this generation are seen in January, February and March, while the pupae are met with in February, March and April. The adults begin their emergence from February until May. Some adults sustain themselves in summer in absence of sufficient normal food, on other kinds of food especially the nectar and the secretions of cotton blossoms and glands of the cotton leaves. Few of these adults survive until early October. Normally, these adults do not deposit eggs in the field in summer. In certain years and localities, however, in presence of sufficient colonies of Aphids, these adults may deposit few eggs which may hatch and give rise to a small, rather unconstant, summer generation. The early eggs of this latter generation are found in the field in about mid-June. Few eggs, however, may be found as early as May if Aphid infestations of cotton occur at this time. The adults of this generation are generally found from July to September or little earlier.

The second constant generation originates from eggs laid either by adults of the first generation which bridged the summer after feeding on nectar, or on summer Aphids, or from adults of the unconstant summer generation. Their eggs are found from about the end of August until October in the vicinity of Aphid colonies generally on maize and *Duranta.* The adults are generally found from late September and May and overwinter until March. Figure 19 summarises the probable sequence of generations of *Coccinella undecimpunctata* in Egypt. Thus it is shown that at least adults may be collected in the fields any time of the year.

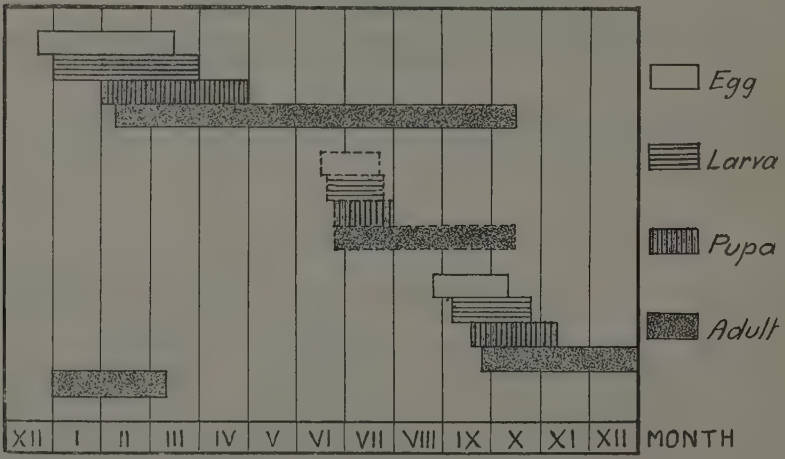


Fig. 19 : Probable sequence of generations of *Coccinella undecimpunctata,* in Egypt.

It may be cautioned that the above generation periods are not always constant. Several factors, including variation of temperature and frequency of Aphids, influence the exact period of each generation. A certain degree of overlapping among the different generations also occurs. Several factors contribute to this overlapping, namely the very considerable differences in the rates of development of individuals in the various stages, the comparatively long life and long oviposition period of adults. This overlapping makes it difficult to define exactly each generation in the field.

Kamal (1951) stated that *Coccinella undecimpunctata* migrates between the Nile Valley and the desert on certain periods of the year. The author would like to point out, however, that he once observed swarms of the beetle flying in the Western Desert about fifty kilometres off Assiut in the road to Kharga Oasis in April, which dispells the idea that the insect might have migrated there in search of food.

CONCLUSION

Willcocks (1925) states that the adluts and larvae of *Coccinella undecimpunctata* feed on the following Aphids : *Aphis maidis, Microsiphum granarium* and *Toxoptera graminum,* and that he has seen small areas of wheat completely and quickly cleared of *Microsiphum granarium* and *Toxoptera graminum* by *Coccinella undecimpunctata.*

Bishara (1934) states that *Coccinella undecimpunctata* is a very useful insect, that it feeds extensively on Aphids and other small insects, that when it is kept in confinement in the insectary it feeds on eggs and larvae of the cotton worm, *Prodenia litura,* and that when both larvae and eggs of the cotton worm and cotton Aphids, *Aphis gossypii,* are provided at the same time, the beetles feed on both but show preference to the Aphids. He argues that because Aphids are very rare in cotton fields in June and July, the beetles met with in cotton fields during these months are more likely to feed upon larvae and eggs of the cotton worm rather than on Aphids.

Kamal (1951) states that *Coccinella undecimpunctata* destroys large colonies of Aphids, mealybugs and *Prodenia litura* eggs and larvae. He claims that beetles fed on *Prodenia* eggs are able to lay as many as 130 eggs and that the beetle prefers Aphida to *Prodenia* larvae and eggs, *Prodenia* larvae to *Prodenia* eggs and young *Prodenia* larvae to more developed larvae of this species.

The experiments and observations made by the writer reveal the following facts.

1. The statements in the literature to the effect that *Coccinella undecimpunctata* plays an effective role in controlling *Prodenia litura* in Egypt are at least highly exaggerated. It was shown in this paper that the beetle normally does not feed or feeds very little on *Prodenia* eggs or its early instars, and prefers even a honey solution to the above mentioned.

2. Aphids are the most important hosts of the beetle in Egypt. Any other hosts such as mealy-bugs, *Prodenia* eggs or larvae and others are only occasionally prayed on. They are not normal hosts for the beetle since it cannot reproduce on them.

3. When plants are infested with Aphids, they attract adult beetles which feed on and deposit their egg-clusters among or in close proximity of Aphid colonies.

4. It is concluded from the longevity and fecundity experiments that the average daily rate of Aphid consumption by the adult beetle is about 70-75 two-third grown *Aphis durantae*. Other experiments show that, under the same conditions, the daily rate of Aphid consumption by the fourth instar larvae is about 90 Aphids, while the rate of consumption of the earlier instars larvae are far less.

Thus, the last larval instar is the most important instar considering the amount of food consumed.

5. When the duration of both the fourth larval instar and the adult stage is taken into consideration, it may be concluded that the adult stage is the most efficient stage of the beetle.

6. Under natural conditions the beetle cleans heavy Aphid infestations after crop injury has taken place. Its value as a practical control measure is therefore limited.

SUMMARY

As a contribution to our knowledge of *Coccinella undecimpunctata aegyptiaca* Reiche, this work is mainly dealing with its biology, life-history, and the real role it plays in controlling some of the pests in Egypt.

The process of hatching is described. It requires about five minutes. The duration of the different immature stages at three different temperatures in the laboratory and two temporatures in the field is determined. In the field, the average duration in summer is ten days (incubation period, 2.5 days ; larval stages, 5.5 days ; pupal stage, 2 days). In winter the average duration is 67 days (incubation period, 13 days ; larval stages, 45.5 days ; pupal stage, 8.5 days).

The feeding capacity of the different larval stages on two-third grown *Aphis durantae* is determined in both laboratory and field. The daily consumption per larva is on the average about 30 Aphids in the laboratory and 10 Aphids in the field. The average number of Aphids consumed by each of the four instar larvae are about 27, 52, 70 and 270 respectively in the laboratory, and about 28, 51, 90 and 286 respectively in the field. When the duration of each larval instar is taken into consideration, the average

numbers of Aphids consumed daily by each instar larva is about 8, 18, 28 and 56 respectively in the laboratory, and about 5, 5, 8 and 21 respectively in the field.

The duration of the larval stage is found to be affected by the amount of food provided to each larva. This duration is 18 days when 15 Aphids are provided daily, while it is 10 days when 45 Aphids are provided daily. The larval duration is not affected when further amounts of Aphids, up to 80 Aphids daily, are provided. The duration of the pupal stage, on the other hand, does not seem to vary significantly with the increase of the amount of Aphids consumed during the larval stage.

The amount of food consumed in the larval stage affects the size of the emerging adult beetle. It averages 2.9 mm. long and 2.0 mm. wide when the larva is provided daily with ten Aphids, while it is 4.9 mm. long and 3.3 mm. wide when it is provided daily with 80 Aphids.

Sex-ratio is about 1:1 throughout the year. The process of mating is described. Mating period averages 5.8 minutes.

The pre-oviposition period varies from about 3 days in summer to about 13 days in winter. In unmated females this period reaches 48 days in winter. The process of oviposition and the arrangement of egg-clusters of both mated and unmated females are described.

Different factors were noted to affect the date and the amount of egg-production. The following factors were experimented :

Temperature seems to be positively correlated with the total number of eggs laid per female and the rate of daily egg production.

Quantity of food consumed by each female is also positively correlated. A minimum daily amount of 30 *Aphis durantae* should be provided to each female to deposit any eggs. The maximum average number of eggs was deposited by females provided by 65 Aphids daily. When different kinds of foods are experimented, it is concluded that oviposition takes place only after feeding on Aphids.

Copulation is also an important factor ; on the average mated females deposit more eggs than unmated females.

Factors affecting longevity of adults were experimented. Longevity of both males and females is positively correlated with the amount of food consumed. The kind of food is an important factor, males and females tolerate starvation for 3-4 days, while they live 62 and 104 days respectively when fed on water and honey. The longevity of beetles feeding on other kinds of foods, i.e. water only, mealy-bugs, *Prodenia* early stages and Aphids fall within these two extremities. There is a regressive correlation between the longevity of the beetles and the average temperature at which they are kept.

Two species of parasites (*Perilitus coccinellae* Schr. and *Tetrastichus coccinellae* Kurdj.) were occasionally noted to parasitise different stages of *Coccinella undecimpunctata.*

The beetle has two distinct generations per year. Under certain conditions, however, a third unconstant summer generation may be found.

It is concluded that Aphids are the most important hosts of the insect in Egypt. Beetles found in cotton fields not infested with Aphids feed on blossom and gland nectar. Owing to the long duration of the adult as compared to the larval stages, the former stage is the most efficient stage of the insect.

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وجمعية فؤاد الأول لعلم الحشرات (١٩٣٨ - ١٩٥٤))

تأسست فى أول أغسطس سنة ١٩٠٧

وضعت تحت رعاية الحكومة المصرية بمرسوم
فى ١٥ مايو سنة ١٩٢٣

القاهرة
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١٩٥٥